Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide

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Preface

This preface explains the objectives, intended audience, and organization of the *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide* and describes the conventions that convey instructions and other information.

The preface contains the following sections:

Objective

This installation guide describes how to install power, air circulation, line card, and external components into and remove them from a Cisco CRS Carrier Routing System 8-Slot Line Card Chassis.

Audience

This guide is for customers who are responsible for installing the line card chassis components. The reader is expected to have installed networking hardware in the past. No additional knowledge of routing or the Cisco IOS-XR software is assumed.

Document Organization

This guide contains the following chapters and appendixes:

- Chapter 1, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Overview," introduces the various line card chassis systems and components.
- Chapter 2, "Installing and Removing Power Components," details how to bring power to and install power components in the line card chassis.

- Chapter 3, "Installing and Removing Air Circulation Components," describes how to install the fan trays and air filters.

- Chapter 4, "Installing and Removing Line Cards, PLIMs, and Associated Components," provides instructions on how to install various cards, including modular services cards, switch fabric cards, route processor cards, and the physical layer interface modules.

- Chapter 5, "Installing and Removing Exterior Components," provides instructions on how to install the chassis exterior components.

- Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications," lists the specifications for the line card chassis.

- Appendix B, "Product IDs for the Cisco CRS 8-Slot Line Card Chassis" lists the product IDs for components of the Cisco CRS Carrier Routing System 8-Slot LCC.

Document Conventions

This guide uses the convention where the symbol **^** represents the key labeled *Control*. For example, the key combination **^z** means hold down the **Control** key while you press the **z** key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. The system prompt indicates the current level of the EXEC command interpreter. For example, the prompt `router>` indicates that you should be at the *user* level, and the prompt `router#` indicates that you should be at the *privileged* level. Access to the privileged level usually requires a password. Refer to the related software configuration and reference documentation listed in Related Cisco CRS Series Documentation for additional information.

- Commands and keywords are in **boldface** font.

- Arguments for which you supply values are in *italic* font.

- Elements in square brackets ([ ]) are optional.

- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and sample console screen displays are in `screen` font.

- Information you enter is in **`boldface screen`** font.

- Nonprinting characters, such as passwords, are in angle brackets (< >).

- Default responses to system prompts are in square brackets ([]).

- Exclamation points (!) at the beginning of a line indicate a comment line.

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Caution Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.** Statement 1074

Related Documentation

For complete information on the CRS 8-Slot Line Card Chassis, see the following publications:

- *Cisco CRS Carrier Routing System Hardware Documentation Guide*
- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Site Planning Guide*
- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*
- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*
- *Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information*
- *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*
- *Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Migration Guide*
- *Cisco CRS Carrier Routing System Ethernet Physical Layer Interface Module Installation Note*
- *Cisco CRS Carrier Routing System Packet-over-SONET/SDH Physical Layer Interface Module Installation Note*

For a complete listing of available software documentation for the Cisco CRS Carrier Routing System, see the About Cisco IOS XR Software Documentation, available online at:

http://www.cisco.com/en/US/products/ps5845/index.html

Then check the links under "Technical Documentation & Tools."

Changes to This Document

Table 1 lists the technical changes made to this document since it was first printed.

Table 1 Changes to This Document

Revision	Date	Change Summary
OL-6256-17	January 2014	Added updates to support the Cisco CRS-X, which includes new line cards, switch fabric cards, and PLIMs.
OL-6256-16	June 2013	Added information about how to replace a SFP on a line card that uses an articulated bracket.

Table 1   Changes to This Document (continued)

Revision	Date	Change Summary
OL-6256-15	July 2011	Added information about new CRS-LSP Label Switch Processor (LSP) card to the following sections: • Chapter 1, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Overview" • Chapter 4, "Installing and Removing Line Cards, PLIMs, and Associated Components" • Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications"
OL-6256-14	July 2011	Added new modular configuration AC cord clamp. Updated Appendix A and added Appendix B. Minor editorial and technical changes were also made.
OL-6256-13	April 2011	Added information about new CRS-8-PRP-6G and CRS-8-PRP-12G Performance Route Processor (PRP) cards. Technical updates and minor editorial changes were also made.
OL-6256-12	November 2010	Updated grounding and modular configuration power sections. Minor editorial and technical changes were also made.
OL-6256-11	October 2010	Added information about the new MSC140 and FP140 line cards; FQ123-140G switch fabric card; 20-port, 14-port, 8-port, and 4-port 10-GE XFP PLIMs; and the 1-port 100-GE CFP PLIM. Minor editorial and technical changes were also made.
OL-6256-10	September 2010	Added new procedures on installing and removing modular configuration power components to Chapter 2, "Installing and Removing Power Components."
OL-6256-09	Jan 2010	Added installation of rear exhaust screen.
OL-6256-08	May 2008	Added new procedures on installing and removing a pillow block to Chapter 4, "Installing and Removing Line Cards, PLIMs, and Associated Components."
OL-6256-07	February 2008	Minor technical changes.
OL-6256-06	August 2007	Updated the document with technical corrections. Also added procedures in Chapter 5, "Installing and Removing Exterior Components," on installing the updated inlet grille.
OL-6256-05	October 2006	Updated the document with technical corrections. Also added procedures in Chapter 5, "Installing and Removing Exterior Components," on installing and removing the front and rear doors, installing and removing the inlet and exhaust grilles, and added procedures for changing the location of the door hinge and adjusting the width of the chassis doors if the doors do not latch properly.

Table 1   Changes to This Document (continued)

Revision	Date	Change Summary
OL-6256-04	April 2006	• Removed Chapter 2, "Unpacking and Mounting the Chassis" from this guide to consolidate this information in the *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*. • Changed the book title to *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide*.
OL-6256-03	December 2005	Updated Chapter 2, "Unpacking and Mounting the Chassis" to reflect new packaging.
OL-6256-02	March 2005	• Updated Chapter 2, "Unpacking and Mounting the Chassis" to include information on mounting the chassis in the rack from the rear. • Updated Chapter 3, "Installing and Removing Power Components" to include new wiring information. • Updated Chapter 5, "Installing and Removing MSCs, PLIMs, and Associated Components" to include information on installing and removing slot covers and impedance carriers.
OL-6256-01	December 2004	Initial release of the document.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Overview

This installation guide describes how to install the power, air circulation, line card, and external components into and remove them from a Cisco CRS Carrier Routing System 8-Slot Line Card Chassis.

This chapter introduces the Cisco CRS 8-slot line card chassis at the highest level. It contains illustrations of the front and rear of the chassis, complete with callouts to each hardware component. For details on each subsystem discussed in this chapter, see *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

This chapter presents the following topics:

Chassis Overview

The Cisco CRS 8-slot line card chassis can be installed in locations where the 16-slot system may not fit (for example, colocation facilities, data centers, and many Tier II and Tier III locations). The routing system consists of a single rack-mount chassis that contains the following major system components:

- Up to eight modular services cards (MSCs), forwarding processor (FP) cards, and label switch processor (LSP) cards, also called line cards (up to eight)
- Physical layer interface modules, or PLIMs (up to eight, one for each line card)
- Route processor (RP) cards (up to two) or performance route processor (PRP) cards (up to two)
- Switch fabric cards (four required)
- SPA Interface Processors (SIPs) and Shared Port Adapters (SPAs) which can be installed instead of PLIMs

- SIP is a carrier card that is similar to a PLIM and inserts into a line card chassis slot and interconnects to an MSC, FP, or LSP like a PLIM. Unlike PLIMs, SIPs provide no network connectivity on their own.

- SPA is a modular type of port adapter that inserts into a subslot of a compatible SIP carrier card to provide network connectivity and increased interface port density. A SIP can hold one or more SPAs, depending on the SIP type and the SPA size. POS/SDH and Gigabit Ethernet SPAs are available.

- A chassis midplane that connects MSCs, FPs, or LSPs to their PLIMs and to switch fabric cards.

The LCC supports 40G, 140G, and 200G fabric cards, as follows:

- The Cisco CRS-1 Carrier Routing System uses fabric cards designed for 40 G operation (CRS-8-FC/S or CRS-8-FC/M cards).

- The Cisco CRS-3 Carrier Routing System uses fabric cards designed for 140G operation (CRS-8-FC140/S or CRS-8-FC140/M cards).

- The Cisco CRS-X Carrier Routing Sytsem uses fabric cards designed for 200G operation (CRS-8-FC400/S cards in 200G mode).

A mixture of 40G, 140G, and 200G fabric cards is not supported except during migration.

![Note icon]

Note   Throughout this document, the generic term Cisco CRS Carrier Routing system refers to the Cisco CRS-1, Cisco CRS-3, and Cisco CRS-X Carrier Routing Systems, unless otherwise specified.

Chassis Components

This section lists the main components of a Cisco CRS 8-slot line card chassis. It primarily identifies the components that are considered field-replaceable units (FRUs), but where additional detail is useful identifies subassemblies that are not field replaceable.

Figure 1-1 shows the front view of a Cisco CRS 8-slot line card chassis with a fixed configuration AC power system installed. The front view of a Cisco CRS 8-slot line card chassis with a fixed configuration DC power system installed is similar.

Figure 1-1   Front (PLIM) View of Line Card Chassis—Fixed Configuration Power Shown
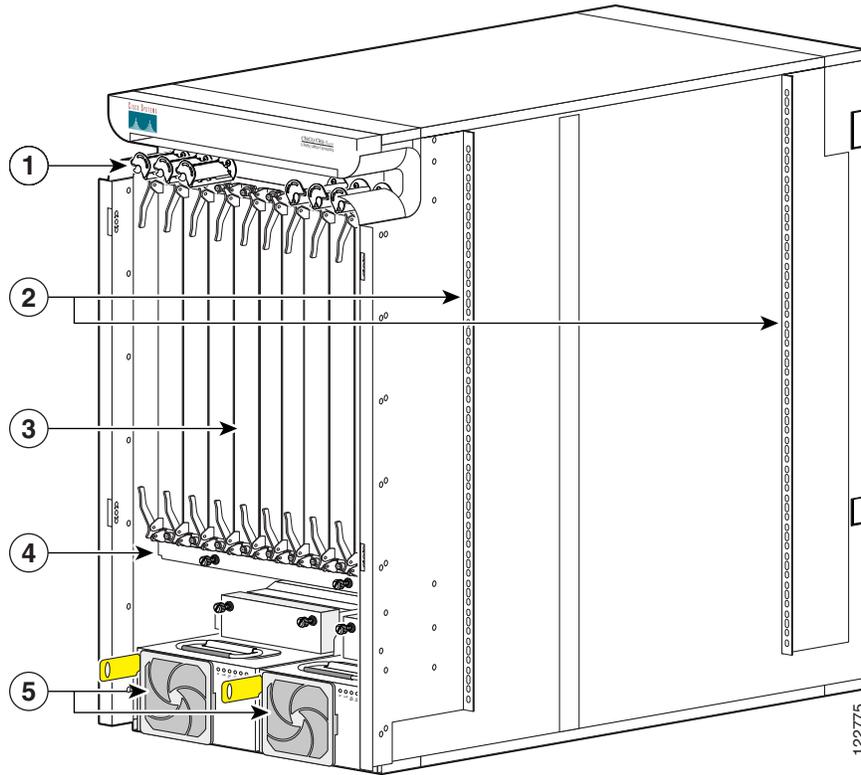
1	Cable management bracket	**4**	Air filter
2	Chassis vertical mounting brackets	**5**	Power System
3	PLIM and RP slots (RPs in middle 2 slots)		

Figure 1-2 shows the rear view of a Cisco CRS 8-slot line card chassis with fixed configuration AC and DC power systems installed.

Figure 1-2   Rear (MSC) View of Line Card Chassis—Fixed Configuration Power Shown

CRS 8-Slot AC Rear

CRS 8-Slot DC Rear
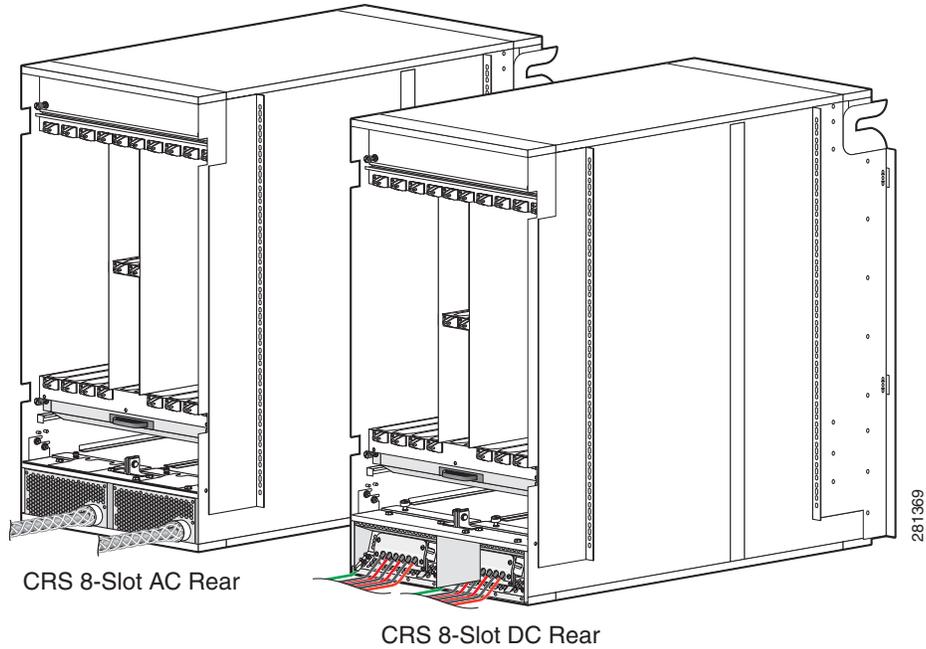
Figure 1-3 shows the front view of a Cisco CRS 8-slot line card chassis with modular configuration AC and DC power systems installed.

Figure 1-3   Front (PLIM) View of Line Card Chassis—Modular Configuration Power Shown

CRS 8-Slot AC Front

CRS 8-Slot DC Front
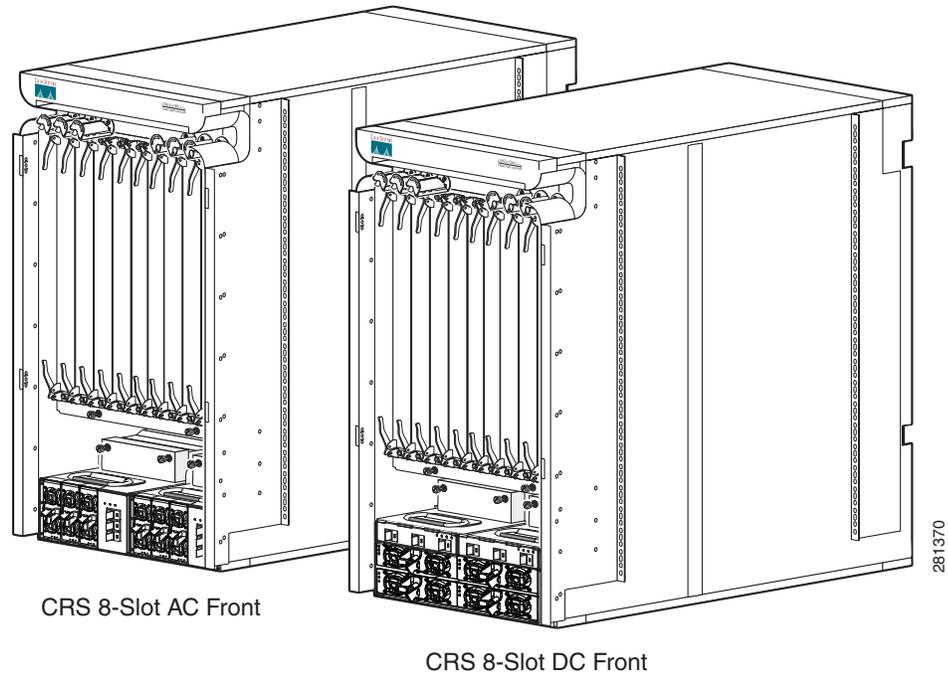
Figure 1-4 shows the rear view of a Cisco CRS 8-slot line card chassis with modular configuration AC and DC power systems installed.

Figure 1-4   *Rear (MSC) View of Line Card Chassis—Modular Configuration Shown*

CRS 8-Slot AC Rear

CRS 8-Slot DC Rear
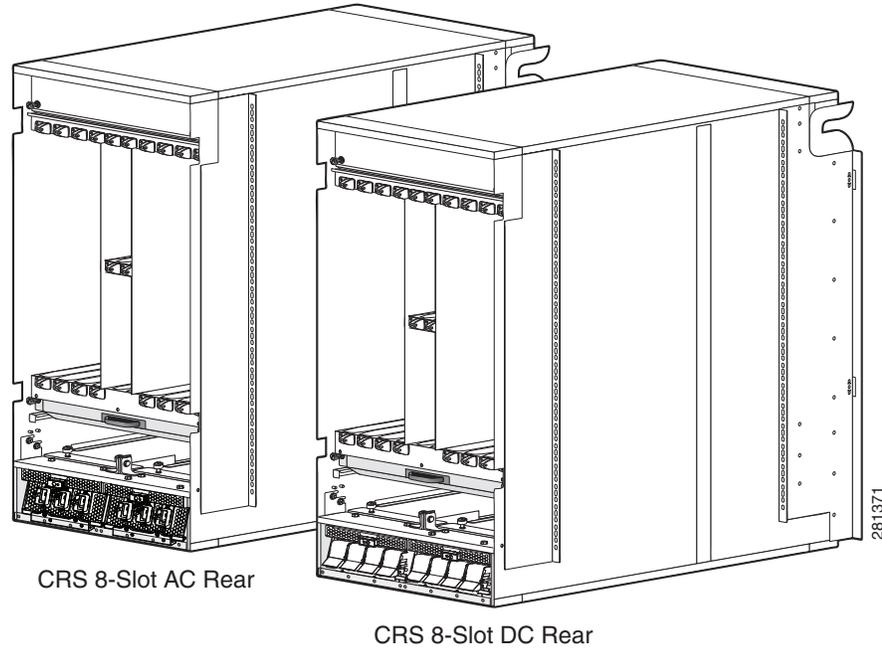
Figure 1-5 shows the rear view of a Cisco CRS 8-slot line card chassis with a fixed configuration AC power system installed.

Figure 1-5   Rear (MSC) View of Line Card Chassis—Fixed Configuration Shown
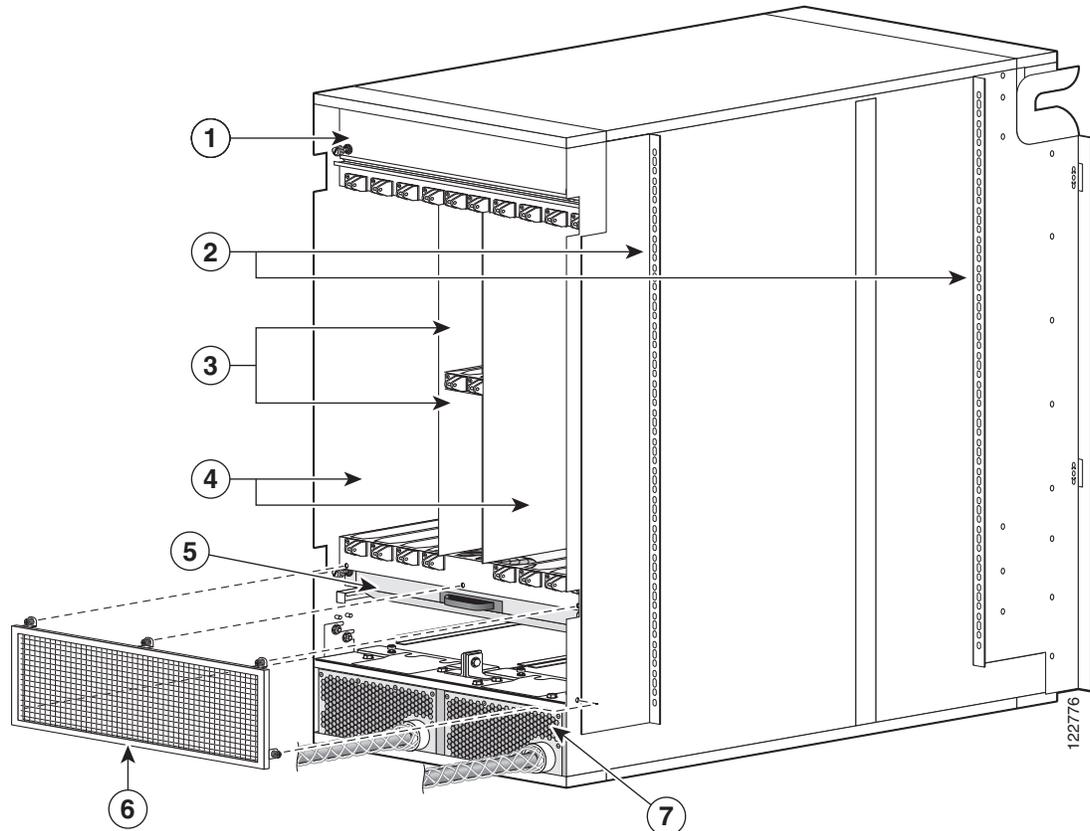
1	Upper fan tray (beneath cover)	**5**	Lower fan tray
2	Chassis vertical mounting brackets	**6**	Rear exhaust screen
3	Switch fabric card (half-height) slots	**7**	Power system
4	MSC slots		

The Cisco CRS 8-slot line card chassis contains:

- As many as eightMSC, FP or LSP cards (all types are also called line cards), and eightPLIMs. The line card and PLIM are an associated pair of cards that mate through the chassis midplane. The line card provides the forwarding engine for Layer 3 routing of user data, and the PLIM provides the physical interface and connectors for the user data. The line card can be associated with several different PLIMs, which provide different interface speeds and technologies.

Note   For a complete list of line cards, route processors, SPAs and SIPs, and interface modules supported in the Cisco CRS 8-slot line card chassis, go to the Cisco Carrier Routing System Data Sheets at: http://www.cisco.com/en/US/products/ps5763/products_data_sheets_list.html.

- A chassis midplane that connects line cards to their associated PLIMs. The midplane design allows a line card to be removed from the chassis without having to disconnect the cables that are attached to the associated PLIM. The midplane distributes power, connects the line cards to the switch fabric cards, and provides control plane interconnections. The midplane is not field replaceable by the customer.

- One or two route processor cards (RPs). The RPs provide the intelligence of the system by functioning as the Cisco CRS 8-slot line card chassis system controller (serving as part of the control plane in multi-chassis systems) and providing route processing. Only one RP is required for system operation. For redundant operation, you can order a second RP as an option (CRS-8-RP/R). When two RPs are used, only one RP is active at a time. The second RP acts as a "standby" RP, serving as a backup if the active RP fails.

  The RP also monitors system alarms and controls the system fans. LEDS on the front panel indicate active alarm conditions.

  A Performance Route Processor (PRP) is also available for the Cisco CRS 8-slot line card chassis. Two PRPs perform the same functions as two RPs, but provide enhanced performance for both route processing and system controller functionality.

Note   A chassis may not be populated with a mix of RP and PRP cards. Both route processor cards should be of the same type (RP or PRP).

- Upper and lower fan trays. The fans pull cool air through the chassis. A removable air filter is located below the PLIM card cage at the front of the chassis.

- Four half-height switch fabric cards (SFCs). These cards provide the three-stage Benes switch fabric for the routing system. The switch fabric performs the cross-connect function of the routing system, connecting every MSC (and its associated PLIM) with every other MSC (and its associated PLIM) in the system.

  The switch fabric receives user data from one line card and PLIM pair and performs the switching necessary to route the data to the appropriate egress line card and PLIM pair. The switch fabric is divided into eight planes that are used to evenly distribute the traffic across the switch fabric. Each switch fabric card implements two planes of the switch fabric.

- A power system that provides redundant power to the chassis. Two types of power systems are available: fixed configuration power and modular configuration power. Both power configurations use either AC or DC power. The fixed configuration power solution contains two power distribution units (PDUs), with either one AC rectifier or one DC power entry modules (PEM) per PDU. The modular configuration power solution contains two power shelves with either up to four DC power modules (PMs) or up to three AC PMs per power shelf.

The PLIM side of the chassis is considered the front of the chassis, where user data cables attach to the PLIMs and cool air enters the chassis. The MSC side, which is where warm air is exhausted, is considered the rear of the chassis.

Chassis Slot Numbers

This section identifies the location and slot numbers for major cards and modules (primarily the field-replaceable units) that plug into the chassis.

Figure 1-6 shows the slot numbering on the front (PLIM) side of the Cisco CRS 8-slot line card chassis.

Figure 1-6   Line Card Chassis Slot Numbering—Front (PLIM) Side
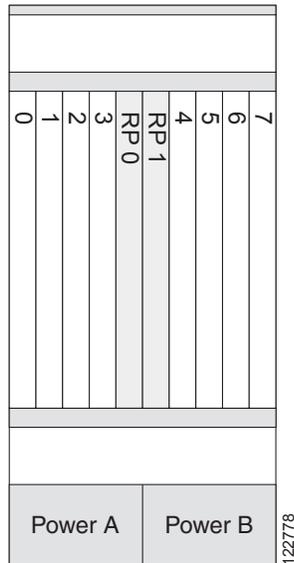
As shown, the Cisco CRS 8-slot line card chassis numbers on the PLIM side of the chassis include the card cage with:

- Eight PLIM slots: left to right, 0, 1, 2, 3, 4, 5, 6, 7
- Two route processor card slots, RP0 and RP1
- Power shelf A and power shelf B

Figure 1-7 shows the slot numbers on the rear (MSC) side of the Cisco CRS 8-slot line card chassis.

Figure 1-7   Line Card Chassis Slot Numbers—Rear (MSC) Side
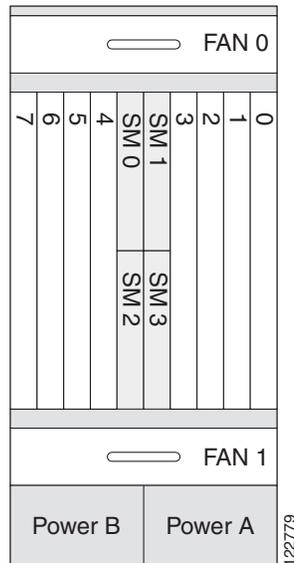
As shown, the slot numbers on the MSC side of the chassis include:

- Fan tray 0 and fan tray 1
- Card cage, including:
  - Eight line card slots (0, 1, 2, 3, 4, 5, 6, 7)
  - Four half-height switch fabric card slots (SM0, SM1, SM2, and SM3)
- Power shelf A and Power shelf B

The MSC slot numbers are reversed from the PLIM slot numbers on the other side of the chassis. Because an MSC mates with its associated PLIM through the midplane, MSC slot 0 is on the far right side of the chassis looking at it from the rear (MSC) side.

PLIM slot 0 is on the far left side of the chassis, looking at if from the front (PLIM) side. MSC slot 0 and PLIM slot 0 mate with each other through the midplane, and so do all other MSC and PLIM slots (0 through 7).

Chassis Cable Management

The Cisco CRS 8-slot line card chassis has cable management features for the front (PLIM) side of the chassis, just above the card cage. The horizontal cable management trays have a special telescoping feature that allows them to be extended when the chassis is upgraded with higher-density cards. This extension also helps when installing the cables in the chassis.

Note   Do not install the front cover on the chassis when the telescoping feature is in use.

Figure 1-8 shows the cable management bracket.

Figure 1-8   ***Cable Management Bracket***
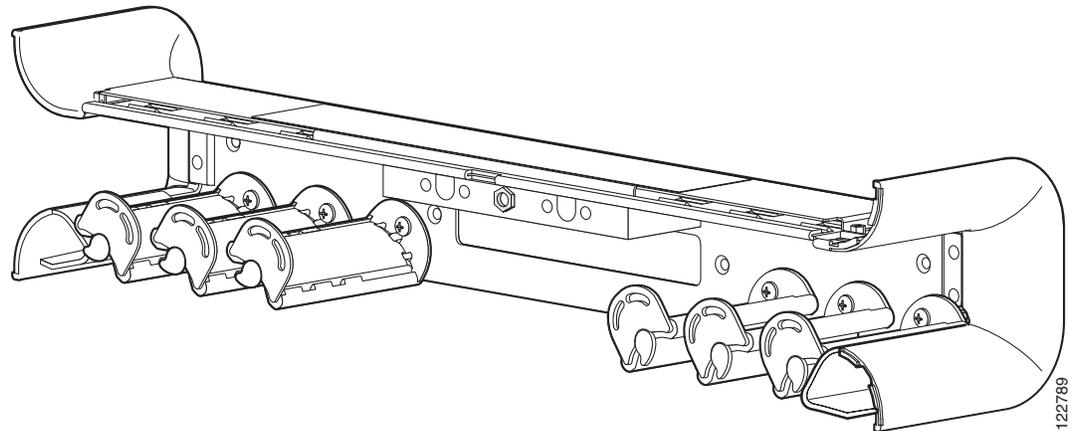
Chassis Cooling System

The chassis has two fan trays, each with four fans, that cool the chassis card cages. Cool air flows in at the bottom front of the chassis and flows through the chassis card cages and through the fans in the fan trays before being exhausted through the bottom rear of the chassis (see Figure 1-9). In addition, each AC or DC power module at the bottom of the chassis has self-contained fans that pull in cool air from the front of the chassis and exhaust warm air out the rear.

A replaceable air filter is located on the front of the chassis below the PLIM card cage. Each fixed configuration power module also has a replaceable air filter that attaches to the module at the front (PLIM) side of the chassis. How often the air filters should be replaced depends on the facility environment. In a dirty environment, or when you start getting frequent temperature alarms, you should always check the intake grills for debris, and then check the air filters to see if they need to be replaced.

Note   We recommend that you check the air filters once a month. Replace a filter when you notice a significant amount of dust.

Figure 1-9   *Airflow Through 8-Slot Line Card Chassis*
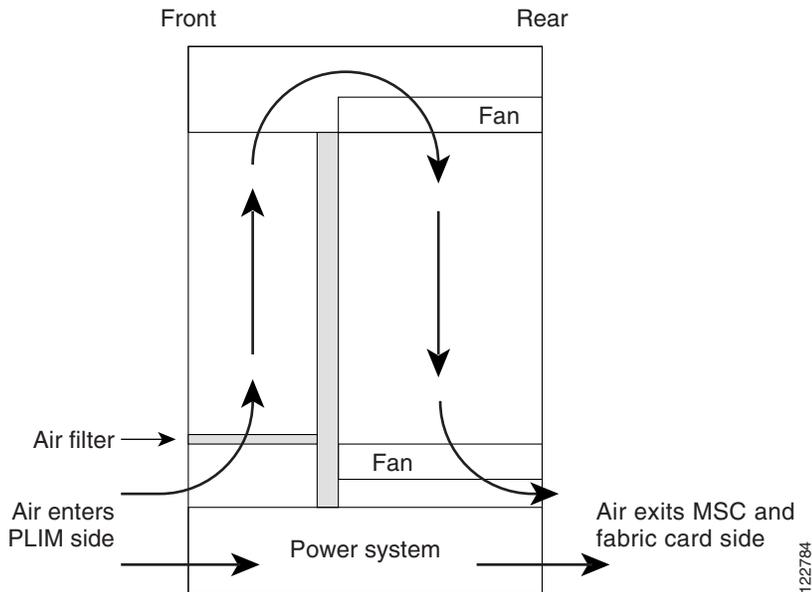
Chassis Power System

Two types of power systems are available for the Cisco CRS 8-slot line card chassis: fixed configuration power and modular configuration power. Both power systems can be powered by either AC or DC power. The chassis power system takes the facility power and converts it to the DC voltage necessary to power chassis components.

For more information, refer to Chapter 2, "Installing and Removing Power Components."

Safety Guidelines

Before you perform any procedure in this document, review the safety guidelines in this section to avoid injuring yourself or damaging the equipment. The following guidelines are for your safety and to protect equipment. The guidelines do not include all hazards. Be alert.

> **Note**   Review the safety warnings listed in *Regulatory Compliance and Safety Information* that are applicable to your router before installing, configuring, or troubleshooting any installed card.

- Keep the work area clear and dust-free during and after installation. Do not allow dirt or debris to enter into any laser-based components.
- Do not wear loose clothing, jewelry, or other items that could get caught in the router while working with line cards, or their associated components.
- Cisco equipment operates safely when used in accordance with its specifications and product-usage instructions.
- Be sure to power down a fixed configuration PDU or modular configuration power shelf before removing it from the chassis.

Preventing Electrostatic Discharge

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. We recommend to use an ESD-preventive strap whenever you handle network equipment or one of its components.

Following are guidelines for preventing ESD damage:

- Always use an ESD-preventive wrist or ankle strap and ensure that it makes good skin contact. Connect the equipment end of the connection cord to an ESD connection socket on the router or to a bare metal surface on the chassis.

- Handle a card by its ejector levers, when applicable, or the card's metal carrier only; avoid touching the board or connector pins.

- Place a removed card board-side-up on an antistatic surface or in a static-shielding bag. If you plan to return the component to the factory, immediately place it in a static-shielding bag.

- Avoid contact between the card and clothing. The wrist strap protects the board only from ESD voltage on the body; ESD voltage on clothing can still cause damage.

Installing and Removing Power Components

This chapter provides instructions on how to install and remove Cisco CRS Carrier Routing System 8-slot line card chassis power components.

Power Systems Overview

There are two options for power systems: the fixed configuration power system and the modular configuration power system. Power components are not interchangeable between the fixed and modular configuration power system.

- *Fixed configuration power system* consists of two power distribution units (PDUs) and either DC power entry modules (PEMs) or AC rectifiers. The AC version requires 3-phase AC-Delta or AC-Wye input power to the PDU. The PDU distributes facility power to the AC rectifier or DC PEM, which in turn provides processed power to the chassis. A removable air filter is located on the front of each DC PEM and AC rectifier. The fixed configuration power system includes SNMP MIBS and XML support.

- *Modular configuration power system* consists of two power shelves and either AC or DC power modules (PMs). However, unlike the fixed configuration power system, the AC version of the modular configuration power system requires single-phase AC input power to power the shelves. If you have 3-phase AC-Delta or AC-Wye at your equipment, a Cisco CRS PDU will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. At the shelf level, the power system provides 2N redundancy; the PMs themselves provide load-share redundancy. The modular configuration power system also includes SNMP MIBs and XML support.

Note In a fixed configuration AC or DC power system, PDU refers to the power component that connects to the AC rectifier or DC PEM.

Note In a modular configuration AC power system, PDU refers to the *Cisco CRS PDU* that converts 3-phase AC-Wye or AC-Delta input power to single-phase AC input power for the modular configuration AC power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

This chapter presents the following topics:

Power Component Information Common to Two Types of Power System

This section contains information shared by the fixed configuration power components and the modular configuration power components in the following topics:

Basic Chassis Power Details

The Cisco CRS 8-slot line card chassis can be configured with either a DC-input power subsystem or an AC-input power subsystem. The chassis power system provides the necessary power for chassis components. Site power requirements differ, depending on the source voltage used.

A fixed configuration AC PDU connects to an AC rectifier, while a fixed configuration DC PDU connects to a DC PEM. A modular configuration AC power shelf houses up to 3 AC PMs, while a modular configuration DC power shelf houses up to 4 DC PMs. It is required that you use only one type of power shelf in a chassis at a time.

Note   In a modular configuration power system, both AC and DC power supplies are referred to as power modules (PMs).

Warning   **This unit might have more than one power supply connection. All connections must be removed to de-energize the unit.** Statement 1028

Fixed Configuration Power System

Three types of PDUs exist for fixed configuration power system:

- AC Wye PDU
- AC Delta PDU
- DC PDU

The AC PDU connects to the AC rectifier, while the DC PDU connects to the DC PEM. Although there are differences among the different PDU types (AC Wye, AC Delta, and DC), they are installed in the same manner. For detailed information, see the "How to Install or Remove Fixed Configuration Power Components" section on page 2-13.

Note The fixed configuration PDUs arrive preassembled in the chassis. AC power cords arrive preattached but the DC power cables need to be installed.

Caution Use only one type of fixed configuration PDU—AC Wye, AC Delta, or DC—and its mating AC rectifier or DC PEM in a chassis at one time.

Modular Configuration Power System

The modular configuration AC power shelves connect to AC PMs, while the modular configuration DC power shelves connect to DC PMs. Although there are differences between the two different power shelf types (AC and DC), they are installed in the same manner. Similarly, the modular configuration AC and DC PMs are installed in the same manner. For detailed information, see the "How to Install or Remove Modular Configuration Power Components" section on page 2-25.

Caution Use only one type of modular configuration power shelf—AC or DC—and its mating AC or DC PMs in a chassis at one time.

Precautions and Recommendations

Follow these precautions and recommendations when planning power connections to the router:

- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner, if necessary.
- Properly ground your system to avoid damage from lightning and power surges.

Note For the fixed configuration power system, although PDUs may be installed or removed without powering down the system, for safety purposes we recommend that you power down the system before you install or remove a PDU.

For the modular configuration power system, although power shelves may be installed or removed without powering down the system, for safety purposes we recommend that you power down the system before you install or remove a power shelf.

Bonding and Grounding Guidelines

The router chassis has safety earth ground connections in conjunction with the power cabling to the fixed configuration PDUs. Modular configuration power supports chassis grounding only. The chassis allows you to connect the central office ground system or interior equipment ground system to the bonding and grounding receptacles on the router chassis, when either a fixed or modular configuration power system is installed. Six chassis grounding points are provided at the rear (MSC) side of the chassis, as shown in Figure 2-1. Each side of the chassis has one pair of threaded ground studs located on the inside of the chassis and two sets of grounding receptacles located on the outside of the chassis. These ground points are also called the network equipment building system (NEBS) bonding and grounding points.

Note These bonding and grounding receptacles satisfy the Telcordia NEBS requirements for bonding and grounding connections.

Figure 2-1 **NEBS Bonding and Grounding Points (Rear of Chassis) - Fixed Configuration AC Power Shown**
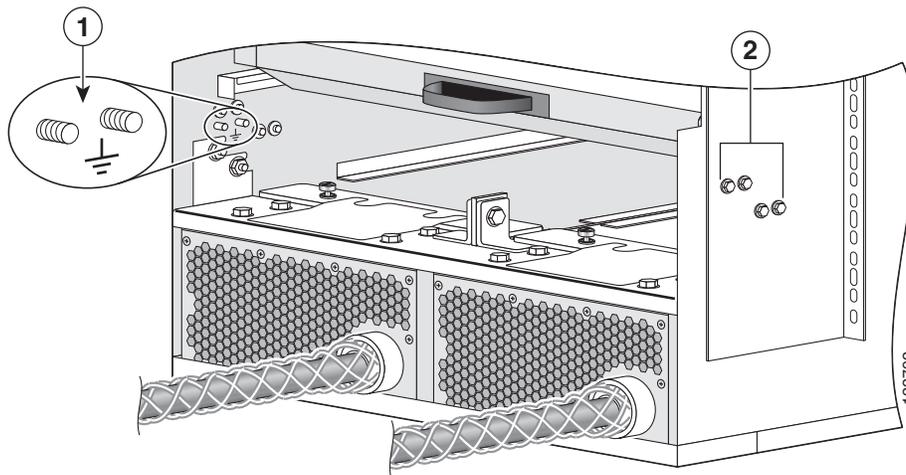
| 1 | NEBS bonding and grounding points (inside chassis) |
| 2 | NEBS bonding and grounding points (outside chassis) |

Caution Do not remove the chassis ground cable unless the chassis is being replaced.

How to Install the Chassis Ground Cable

This section describes how to install the ground cable on the Cisco CRS 8-slot line card chassis.

Prerequisites

To connect the routing system to a network equipment building system (NEBS)-compliant bonding and grounding system at the site, you must have the following:

- Minimum of one grounding lug that has two M6 bolt holes with 0.63-inch (5/8 inch) (1.6 cm) of spacing between them, center to center, and a 6-AWG multistrand copper cable. The lug is similar to the type used for the DC-input power supply leads, as shown in Figure 2-4.

- Four M6 or equivalent hex-head nuts with integrated locking washers are shipped pre-installed on the inside of the chassis.

- Eight M6 or equivalent hex-head bolts with integrated locking washers are shipped pre-installed on the outside of the chassis.

- Ground cable routed upwards or downwards, per customer installation requirements. Although we recommend at least 6-AWG multistrand copper cable, the actual cable diameter and length depend on your router location and site environment. This cable is not available from Cisco Systems; it is available from any commercial cable vendor. The ground cable should be sized according to local and national installation requirements.

⚠ **Caution**   The DC Return of the Cisco CRS 8-slot chassis should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

Required Tools and Equipment

You need the following tools to perform this task:

- One ground lug for equipment-side ground connection. In a rack application, the rack-side of the ground cable will also require a lug.

- Ground cable

- Crimping tool and lug specific die

- 10-mm 6 pt. combination wrench

- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 30 in.-lb (3.39 N-m)

Steps

To attach the ground cable to the chassis, perform the following steps:

Step 1   Use the crimping tool mandated by the lug manufacturer to crimp the lug to the ground cable.

Step 2   Using the 10-mm wrench, attach the ground cable to one of the grounding points at the rear of the chassis. Then use the torque wrench to tighten to a torque of 30 in.-lb (3.39 N-m). Figure 2-2 shows how the ground cable is attached to the ground points on the outside of the chassis.

Figure 2-2   Ground Cables Attached to Chassis Grounding Points
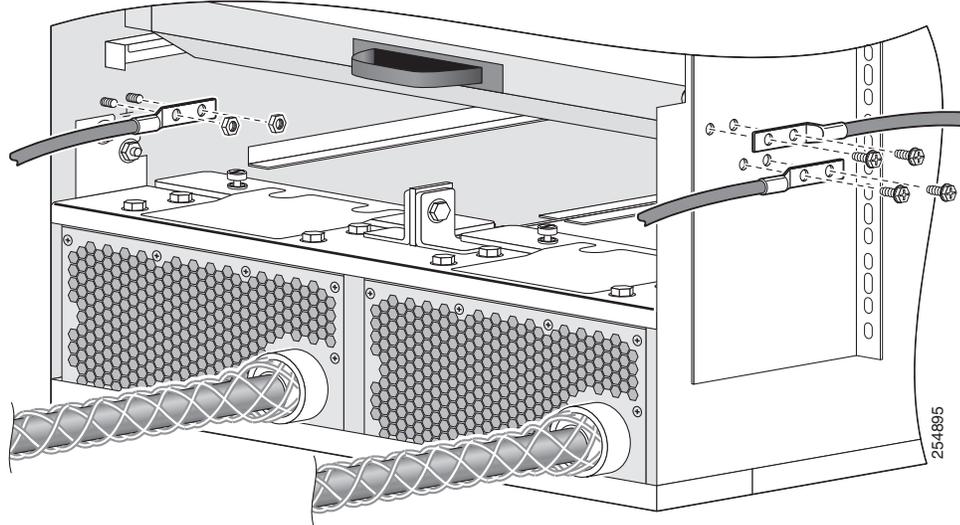
| 1 | NEBS bonding and grounding points (inside chassis) |
| 2 | NEBS bonding and grounding points (outside chassis) |

DC Power Systems

Each DC powered chassis contains two fixed configuration PDUs or two modular configuration power shelves for 2N redundancy.

- In the fixed configuration power system, each PDU accepts one DC PEM for 2N redundancy. The PDUs and PEMs are field replaceable. The PDUs contain the input power connectors.

- In the modular configuration power system, each power shelf accepts up to four DC PMs. The power shelves and DC PMs are field replaceable. The power shelves contain the input power connectors.

✎
Note   Depending on the hardware deployed at your site, your system may not consume the maximum power supplied by the power system.

Fixed Configuration DC Power

The Cisco CRS 8-slot line card chassis DC power system provides 7,500 watts to power the chassis. Each DC PDU is connected to three pairs of DC power feeds and powers a single DC PEM. Input DC power enters the PDU and is passed to the PEM, which provides power to the components in the chassis.

- Each DC PEM has its own circuit breaker.

- The fixed configuration power system distributes power in power zones.

- The DC PDUs and DC PEMs are field replaceable.

Unlike the Cisco CRS 16-slot line card chassis, the Cisco CRS 8-slot line card chassis does not contain an alarm module. A microprocessor in the DC PEM monitors the status of each DC PEM. The microprocessor communicates with the system controller on the route processor (RP) card. LEDs on the front panel of the RP card indicate active alarm conditions.

The DC PDU is shipped with a plastic safety cover over the input terminal block, as shown in Figure 2-3. This safety cover has two parts, each part held on to the PDU with a Phillips screw. We recommend removing the safety cover only when wiring and unwiring the chassis. The safety cover is slotted in such a way that the cables can only come out on the bottom portion of the cover.

Figure 2-3   Fixed Configuration DC PDU with Plastic Safety Cover
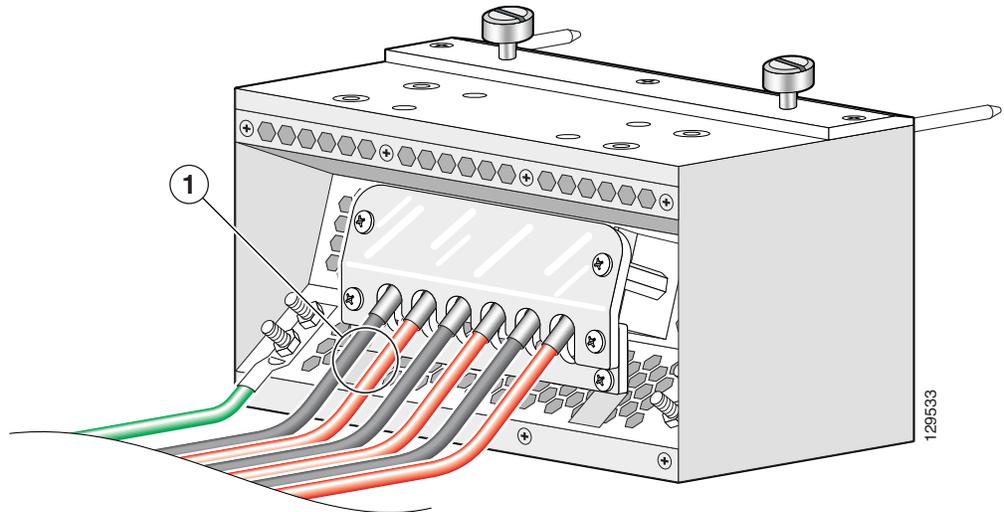
1	Each set of cables (RTN and –48 V/–60 V) is a single VDC input.

Each PDU requires three DC inputs of –48/–60 VDC (nominal), 60 A service. The PDU has three sets of double-stud terminals (-48/-60 VDC Lines and -48/-60 VDC Returns) for connecting to the VDC inputs.

Each DC PDU should be connected to a different central office DC power source:

- One PDU should be connected to three –48/–60 VDC "A" buses.
- Other PDU should be connected to three –48/–60 VDC "B" buses.

If DC power to a PDU fails, the other PDU provides enough power for the chassis. This 2N power redundancy enables the routing system to operate in spite of single power failure.

For DC power cables, we recommend that you use commensurately rated, high-strand-count copper cable. These cables are not available from Cisco Systems; they are available from any commercial vendor. DC power cables must be terminated by cable lugs at the power shelf end.

Note   All six -48/-60 VDC Return input cables for one chassis should have the same cable gauges and the lengths should be matched within 10 percent of deviation.

The grounding lugs should be dual-hole and able to fit over M6 terminal studs at 0.63 in (1.6 cm) centers, as shown in Figure 2-4 (for example, Panduit part number LCD2-14A-Q, or equivalent).

Figure 2-4   *DC Power Grounding Cable Lug*
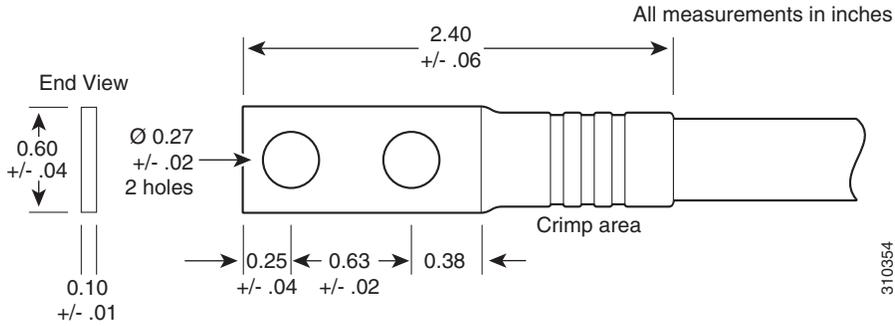
The terminal lugs (in other words, all lugs not used for grounding) should be 45-degree angled, industry-standard dual-hole compressions lugs, and able to fit over M6 terminal studs at 0.63 in (1.6 cm) centers, as shown in Figure 2-5.

Note   In the fixed configuration power system, power cables have a 20 in.-lb (2.26 N-m) torque value and ground cables have a 30 in.-lb (3.39 N-m) torque value. The PDU mounting screws have a 9 in.-lb (1.04 N-m) torque value.

Figure 2-5   *DC Power Cable Lug*
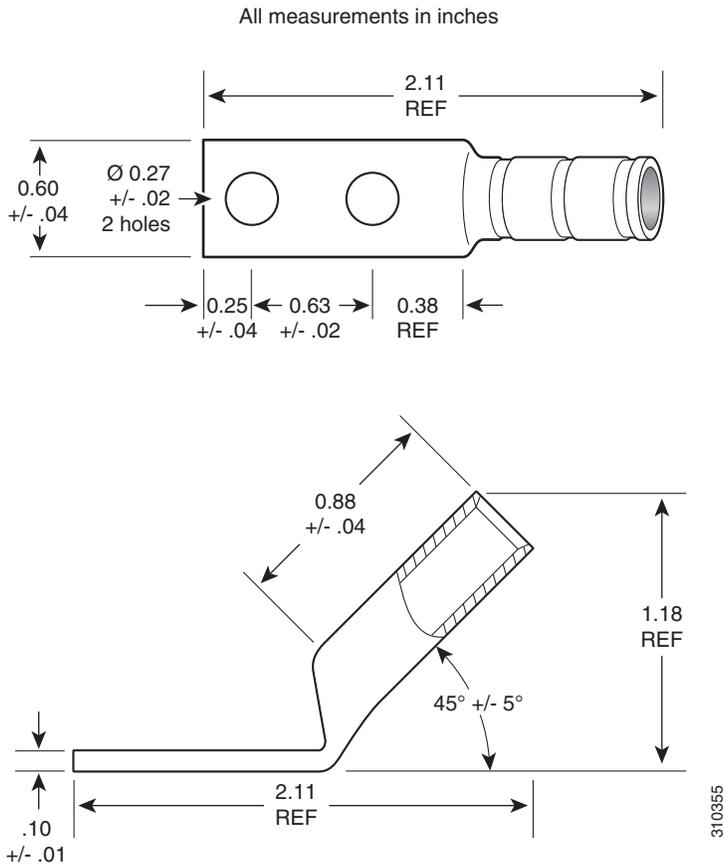
The color coding of the source DC power cable leads depends on the color coding of the site DC power source. Typically, green or green and yellow indicates that the cable is a ground cable. Follow your local practices for cable color code and markings. You must ensure that the power cables are connected to the DC-input power shelf terminal studs in the proper positive (+) and negative (–) polarity.

In some cases, the source DC cable leads might have a positive (+) or negative (–) label, but you must verify the polarity by measuring the voltage between the DC cable leads. When making the measurement, the positive (+) lead and negative (–) lead must always match the (+) and (–) labels on the PDU.

⚠

Caution   When installing DC power cables, make sure that the polarity of the DC input wiring is correct.

For additional power details, see Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications" or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

Modular Configuration DC Power

The Cisco CRS 8-slot line card chassis modular configuration DC power system can provide up to 8,400 W to power the line card chassis. The modular configuration DC power system uses A or B power shelves to provide reliable, 2N redundant power to all chassis components.

✎

Note   Depending on the hardware deployed at your site, your system may not consume the maximum power supplied by the power system.

The Cisco CRS 8-slot line card chassis does not contain an alarm module. The DC PM monitors PM status and processes alarm functions. The PM distributes power and passes PM status signals to the system. Alarms are processed through the route processor (RP). LEDs on the front panel of the RP card indicate active alarm conditions.

If DC power to one modular configuration power shelf fails, the other power shelf provides enough power for the chassis. This 2N power redundancy enables the routing system to operate in spite of single power failure.

Each power shelf operates with up to four DC inputs of –48/–60 VDC (nominal), 60 A. The power shelf accepts input DC power in the range –40 to –72 VDC.

Figure 2-6 shows the wiring on the rear of a modular configuration DC power shelf.

Figure 2-6   Modular Configuration DC Power Shelf Wiring
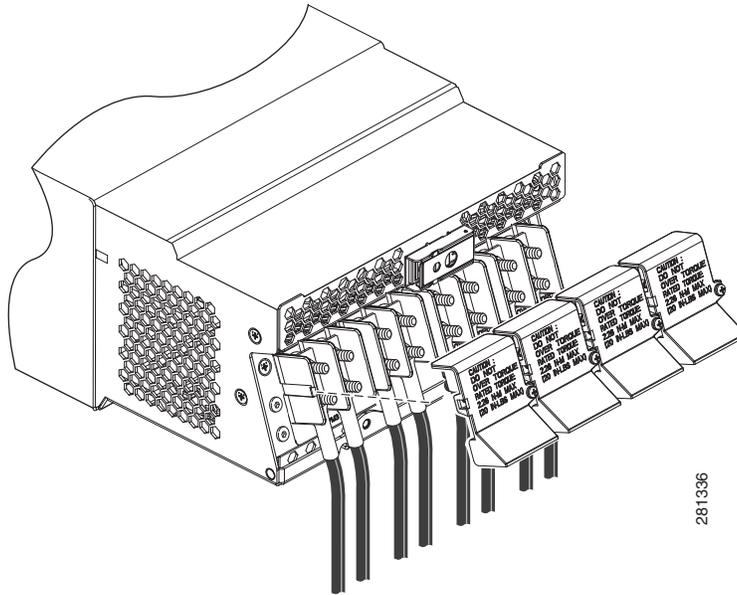
We recommend that the terminal block covers, shown in Figure 2-6, should only be removed when wiring and unwiring the power shelf. The terminal block cover is slotted in such a way that cables can only come out the bottom portion of each cover.

The power supply terminal block lug opening width is 0.63 inch (1.6 cm). The terminal posts are centered 0.63 inches (5/8 inch) (1.6 cm) apart and are M6-threaded. We recommend that you use an appropriately sized 180-degree angle (straight) industry standard 2-hole, standard barrel compression lug, as shown in Figure 2-7, or an appropriately sized 45-degree angle industry standard 2-hole, standard barrel compression lug, as shown in Figure 2-8.

Figure 2-7   180-Degree (Straight) DC Power Cable Lug
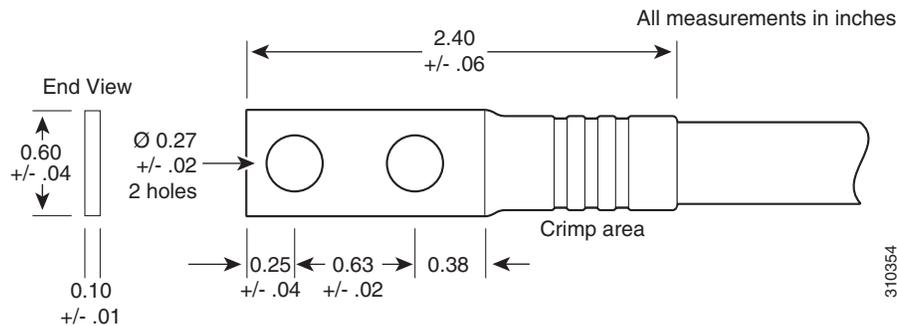
Figure 2-8   *45-Degree DC Power Cable Lug*

All measurements in inches
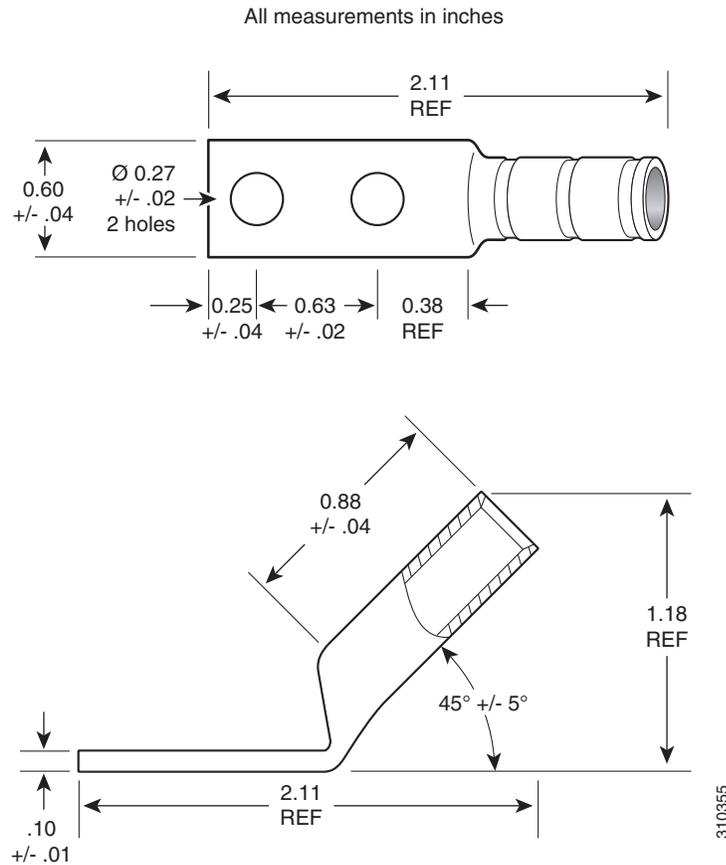
Note   In the modular configuration power system, DC power cables have a torque value of 20 in.-lb (2.26 N-m) and chassis ground cable connectors have a torque value of 30 in.-lb (3.39 N-m).

For additional power details, see Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications" or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

AC Power Systems

Each AC powered chassis contains two fixed configuration AC PDUs or two modular configuration AC power shelves for 2N redundancy.

- In the fixed configuration power system, each PDU accepts one AC power rectifier. The PDUs and AC power rectifiers are field replaceable.

- In the modular configuration power system, each power shelf can contain up to three AC PMs. The power shelves and the AC PMs are field replaceable.

Note   Depending on the hardware deployed at your site, your system may not consume the maximum power supplied by the power system.

Fixed Configuration AC Power

An AC-powered Cisco CRS 8-slot line card chassis contains two AC power distribution units (PDUs) and two AC rectifier modules. Each AC PDU is connected to a 3-phase (200 to 240) input VAC power source and connects to a single 7500-watt AC rectifier module that is field replaceable. Each AC rectifier module converts input AC power to the 54.5 VDC used by the Cisco CRS 8-slot line card chassis. Each rectifier has its own circuit breaker.

To provide 2N power redundancy for the Cisco CRS 8-slot line card chassis, each PDU and AC rectifier pair is connected to a different AC power source. During normal operation when both power sources are operational, both PDUs and rectifiers function together to power the chassis. However, if a power source fails, the other power source provides the other PDU and rectifier pair with enough input power to power the chassis. This 2N power redundancy enables the routing system to operate despite the power failure.

Two versions of the AC PDU are available to accommodate AC input power in either the Delta or Wye configuration. Each PDU has a different Cisco part number. The PDUs are shipped with AC power cords that are 14 feet (4.3 m) long.

Unlike the Cisco CRS 16-slot line card chassis, the Cisco CRS 8-slot line card chassis does not contain an alarm module. A microprocessor in the AC rectifier monitors the status of each AC rectifier. The microprocessor communicates with the system controller on the RP card. LEDs on the front panel of the RP card indicate active alarm conditions.

The AC PDUs have the following input VAC power requirements:

- AC Wye input: 3-phase, 200 to 240 VAC nominal (phase-to-neutral), 50 to 60 Hz, 16 A (International) or 20 A (North America). The PDU is rated for 14-amp service, and accepts AC input of 16 or 20 A.

    The Wye power cord has a 5-pin IEC 60309 plug that is rated for 400 VAC, 16 or 20 A, (3W + N + PE). The power cord plugs into a similarly rated IEC 60309 receptacle.

- AC Delta input: 3-phase, 200 to 240 VAC nominal (phase-to-phase), 50 to 60 Hz, 30 A. The PDU is rated for 24-amp service, and accepts AC input of 30 A.

    The Delta power cord has a 4-pin NEMA L15-30P plug that is rated for 250 VAC, 30 A (3W + PE). The power cord plugs into a similarly rated NEMA L15-30R locking-type receptacle.

For additional power details, see Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications" or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

Modular Configuration AC Power

The Cisco CRS 8-slot line card chassis modular configuration AC power system can provide up to 9,000 W to power the line card chassis.

Note Depending on the hardware deployed at your site, your system may not consume the maximum power supplied by the power system.

The modular configuration power system provides the following features:

- AC power shelf redundancy
- PM load-share redundancy
- Elimination of power zone distribution, while maintaining zone protection
- Capacity for future growth

The modular configuration AC power systems use A or B power shelves to provide reliable, 2N redundant power to all chassis components.

The Cisco CRS 8-slot line card chassis does not contain an alarm module. The AC PM monitors PM status and processes alarm functions. The AC PM distributes power and passes PM status signals to the system. Each PM has its own integrated fuse to protect the system, and each PM is plugged into its own power outlet. Alarms are processed through the RP. LEDs on the front panel of the RP indicate active alarm conditions.

Unlike the fixed configuration AC power system, which requires 3-phase AC Delta or AC Wye input power, the modular configuration AC power system requires single-phase AC input power. If you have 3-phase AC Delta or AC Wye at your equipment, a *Cisco CRS PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

The modular configuration AC power shelf has the following input VAC power requirements:

- Single-phase, 200 to 240 VAC nominal, 50 to 60 Hz, 16 A.

  Each power shelf contains three IEC-320-C22 receptacles which can accept up to three IEC-320-C21 connector female cords.

✎
Note   In order to maintain a balanced 3-phase power load, three AC PMs are required to be installed in a Cisco CRS 8-slot line card chassis AC modular configuration power shelf.

✎
Note   If single-phase AC power is available at your site, we recommend that you use appropriate short-circuit protection in compliance with national and local electrical codes.

For additional power details, see Appendix A, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications" or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

How to Install or Remove Fixed Configuration Power Components

This section contains the following procedures:

> **Note** Although there are differences among the different fixed configuration PDU types (AC Wye, AC Delta, and DC), they are installed in the same manner.

> **Note** Although there are differences between the AC rectifier and DC PEM (AC Wye, AC Delta, and DC), they are installed in the same manner.

Before Powering the Chassis Up or Down

While the line card chassis does not have a single power switch that powers the entire chassis and all its components up and down, the AC rectifier or DC PEM linkage cuts power to the chassis as a whole when both power components are turned off. Most components on the chassis, such as the power modules, MSCs, PLIMs, and fan trays can be removed or installed in the chassis while it is running.

Before you can power the chassis up, perform the following steps:

Step 1 Install and wire the PDUs (see the "Installing a PDU" section on page 2-15).

Step 2 Install the DC PEMs or AC rectifiers (see the "Installing a DC PEM or AC Rectifier" section on page 2-22).

Step 3 Install the RP card (see the "Installing an RP, PRP, or DRP Card" section on page 4-38).

Step 4 Activate your power source.

Step 5 Turn the PEM switches to the on position.

To power down the chassis entirely, you must power down each of the two DC PEMs or AC rectifiers; you move each power switch to the off position by pulling it toward you. Both DC PEMs or AC rectifiers must be disconnected or the PDUs unplugged to de-energize the chassis completely.

> **Note** After powering off the AC rectifier, wait a minimum of 20 seconds before powering it on again.

> **Note** All power cords must be unplugged from wall power to fully remove power from the chassis.

Converting from One Fixed Configuration Power System to Another

To convert a Cisco CRS 8-slot line card chassis with a fixed configuration power system from AC to DC power, or from DC to AC power, perform the following steps:

Step 1 Power down the chassis completely. See the "How to Install or Remove Fixed Configuration Power Components" section on page 2-13.

Step 2 Remove the DC PEMs or AC rectifiers. See the "Removing a DC PEM or AC rectifier" section on page 2-23.

Step 3 Remove the PDUs. See the "Removing a PDU" section on page 2-17.

Step 4   Install the new PDUs. See the "Installing a PDU" section on page 2-15.

If you are converting from AC to DC power, you must wire the PDU properly. See the "Installing DC PDU Cables" section on page 2-19.

Step 5   Install the DC PEMs or AC rectifiers. See the "Installing a DC PEM or AC Rectifier" section on page 2-22.

Step 6   Power the chassis back up. See the "How to Install or Remove Fixed Configuration Power Components" section on page 2-13.

⚠

Caution   Use only one type of fixed configuration PDU—AC Wye, AC Delta, or DC—and its mating AC rectifier or DC PEM in a chassis at one time.

Installing a PDU

This section describes how to install a PDU in the Cisco CRS 8-slot line card chassis. For information on the difference between the power types, see the "DC Power Systems" section on page 2-6 and the "AC Power Systems" section on page 2-11.

The PDU is installed into the back of the chassis. After the PDU is installed, you can slide the DC PEMs or AC rectifiers into the chassis and connect them to the PDU to provide power to the chassis (see the "Installing a DC PEM or AC Rectifier" section on page 2-22 for details). Although there are differences among the different PDU types (AC Wye, AC Delta, and DC), they are installed in the same manner.

Figure 2-9 shows a fixed configuration AC Wye PDU.

Figure 2-9   Fixed Configuration AC Wye PDU
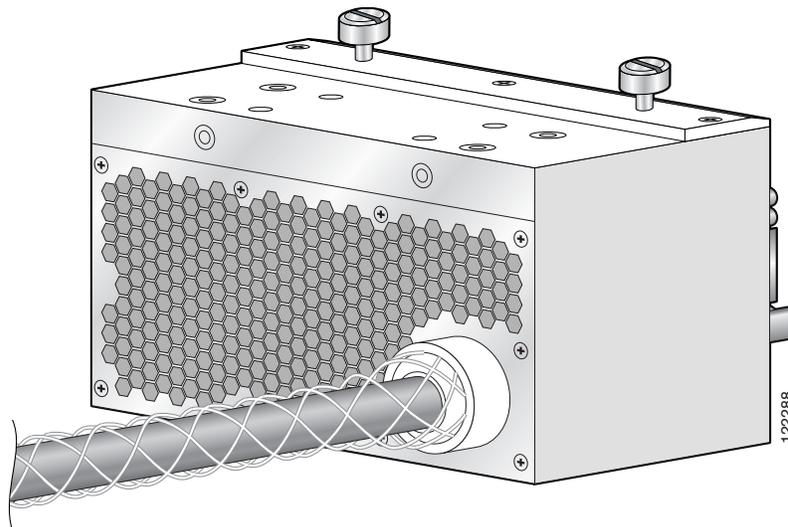
Prerequisites

Before performing this task, remove any front cosmetic covers.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- 3/8-in. ratchet wrench with 10-mm socket
- 3/8-in. ratchet wrench with 8-mm socket or open (box end) wrench
- Fixed configuration PDU
    - AC Wye PDU Cisco product number CRS-8-LCC-PDU-ACW=, or
    - AC Delta PDU Cisco product number CRS-8-LCC-PDU-ACD=, or
    - DC PDU Cisco product number CRS-8-LCC-PDU-DC=

Steps

To install a PDU, perform the following steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Make sure that the PDU is unplugged.

Step 3 Grasp the PDU by the side and set it carefully into place in a PDU slot on the rear (MSC) side of the chassis. Be sure to lift the PDU over the lip on the edge of the chassis, and align the guide pins on the chassis with the guide holes on the PDU.

⚠

Caution Do not lift the PDU by the power cord—doing so can damage the PDU or the cord.

Step 4 If needed, put the second PDU into place in the other PDU slot on the chassis.

✎

Note The PDU holding plate bolts to both PDUs and the side of the interior of the chassis.

Step 5 Install the PDU holding plate.

    a. Slide the holding plate into place on top of the PDU, using the guide bolts on the side of the chassis to place it correctly.

    b. Use the socket wrench to bolt the holding plate to the top of the PDUs with the eight 10-mm bolts (four for each PDU).

    c. Use the socket wrench to bolt the holding plate to the interior of the side of the chassis with the four 8-mm bolts (two for each side).

Step 6 Use the socket wrench to install the 8-mm center holding bolt and the 10-mm nut.

What to Do Next

After performing this task, install the DC PEMs or AC rectifiers (see the "Installing a DC PEM or AC Rectifier" section on page 2-22).

> ✎
> **Note**   After installing a DC PDU, you need to connect the DC input wiring before installing the DC PEMs. For more information, see the "Installing DC PDU Cables" section on page 2-19.

Removing a PDU

This section describes how to remove a PDU in the Cisco CRS 8-slot line card chassis. For information on the difference between the power types, see the "DC Power Systems" section on page 2-6 and the "AC Power Systems" section on page 2-11.

The PDU is located at the back of the chassis. Although there are differences among the different PDU types (AC Wye, AC Delta, and DC), they are installed in the same manner. Figure 2-10 shows a fixed configuration AC Wye PDU.

Figure 2-10   Fixed Configuration AC Wye PDU
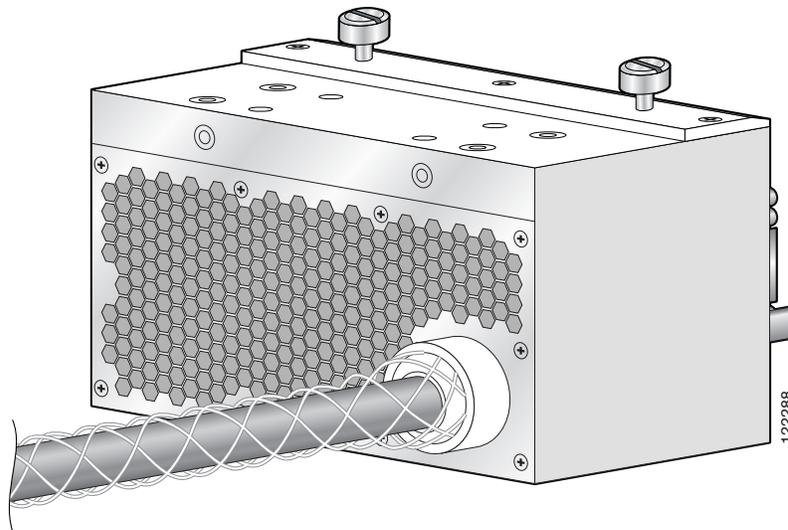
Prerequisites

Before performing this task, remove any front cosmetic covers, power down and remove the DC PEMs or AC rectifiers, and unplug the PDU. See the "How to Install or Remove Fixed Configuration Power Components" section on page 2-13, and the "Removing a DC PEM or AC rectifier" section on page 2-23.

If you are removing a DC PDU, see the "DC Power Systems" section on page 2-6; if you are removing an AC PDU, see the "AC Power Systems" section on page 2-11 for more information.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 3/8 in. ratchet wrench with 10-mm socket
- 3/8 in. ratchet wrench with 8-mm socket or open (box end) wrench

Steps

To remove a fixed configuration PDU, perform the following steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Turn the DC PEM or AC rectifier power switch to the off position.

Step 3 Disconnect the PDU from the power source.

Step 4 Remove the DC PEM or AC rectifiers from the PDU that you are removing from the chassis (see the "Removing a DC PEM or AC rectifier" section on page 2-23).

Step 5 For fixed configuration DC only, remove the power cables and ground cable connected to the rear of the DC PDU. See the "Removing DC PDU Wiring" section on page 2-21.

Step 6 On the rear (MSC) side of the chassis, Use the socket wrench to remove the 8-mm center holding bolt and 8-mm nut from the PDU holding plate.

Step 7 Remove the PDU holding plate.

    a. Use the socket wrench to unbolt the four 8-mm bolts (two for each side) that attach the holding plate to the interior of the side of chassis.

    b. Use the socket wrench to unbolt the eight 10-mm bolts (four for each PDU) that attach the holding plate to the top of the PDUs.

    c. Carefully remove the holding plate from the top of the PDUs and set it aside.

Step 8 Grasp the PDU and lift it carefully over the lip at the back of the chassis and set it carefully aside.

⚠

Caution Do not lift the PDU by the power cord—doing so can damage the PDU or the cord.

What to Do Next

After performing this task, you may install a new PDU, if needed (see the "Installing a PDU" section on page 2-15), and replace any cosmetic covers.

Installing DC PDU Cables

This section describes how to wire the fixed configuration DC PDU. For more detailed information on chassis DC power systems, see the "DC Power Systems" section on page 2-6.

Figure 2-11 shows the power cable connections at the rear of the fixed configuration DC PDU.

Figure 2-11   Fixed Configuration DC PDU Power Cable Connections
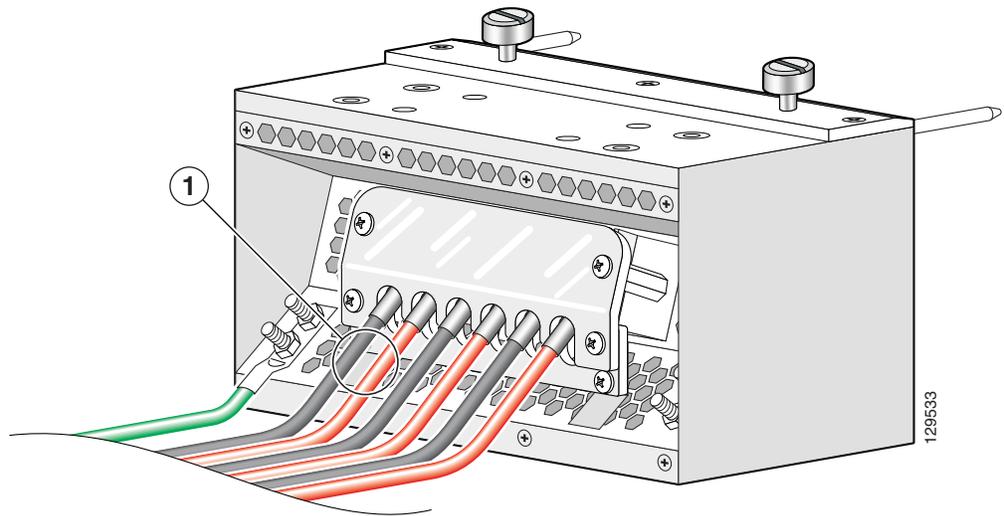
1	Each set of cables (RTN and –48 V/–60V) is a single VDC input.

Caution   When wiring the PDU, be sure to attach the ground cable first and tighten the nuts to a torque of 30 in-lb (3.39 N-m). When removing the wiring, be sure to remove the ground cable last.

Prerequisites

Before performing this task, ensure that both power shelves are installed in the chassis.

Note   Before installing wiring on the power shelf, make sure that the input power cables are not energized.

Note   If cables are wrapped with black electrical tape, be sure to remove tape from cables before installing cabling on the power shelf.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Crimping tool and lug specific die
- 3/8 in. ratchet wrench with 10-mm socket
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 30 in.-lb (3.39 N-m)
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 20 in.-lb (2.26 N-m

Steps

To wire the DC PDU, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Remove the upper plastic terminal block safety cover (leave the lower safety cover in place; as shown in Figure 2-11). Using a standard Phillips screwdriver, remove the four screws holding the upper plastic safety cover to the wiring terminal block.

Step 3   Use the crimping tool mandated by the lug manufacturer to crimp the lugs to the DC-input cables and the ground cable. For details on lugs, see the "DC Power Systems" section on page 2-6.

The cable should be sized according to local and national installation requirements.

✎

Note   The terminal posts are centered 0.63 inches (5/8 inch) (1.60 cm) apart and are M6-threaded. We recommend that you use an appropriately sized 45-degree angled industry standard 2-hole, standard barrel compression lug.

Step 4   Using the 10-mm socket wrench, attach the ground cable to the ground cable terminal. Then use the torque wrench to tighten to a torque of 30 in.-lb (3.39 N-m).

Step 5   Using the 10-mm socket wrench, attach the three negative cables (the red cables as shown in Figure 2-11) and the three positive cables (the black cables as shown in Figure 2-11) to the terminal block. Then use the torque wrench to tighten to a torque of 20 in.-lb (2.26 N-m).

Step 6   Reattach the upper plastic safety cover with a Phillips screwdriver. Insert and tighten the four screws holding the cover to the wiring terminal block.

Removing DC PDU Wiring

This section describes how to remove the wiring from the fixed configuration DC PDU. For more detailed information on chassis DC power systems, see the "DC Power Systems" section on page 2-6.

⚠️

Caution   When removing DC wiring from the fixed configuration DC PDU be sure to remove the ground cable last.

Prerequisites

Before performing this task, power down and remove DC PEMs in the shelf you want to disconnect.

✎

Note   Before removing wiring from the power shelf, make sure that the power cord is not plugged into the facility power.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 3/8-in. ratchet wrench with 10-mm socket

Steps

To remove the wiring from the DC PDU, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Remove the upper plastic terminal block safety cover (leave the lower safety cover in place; as shown in Figure 2-11). Using a standard Phillips screwdriver, remove the four screws holding the upper plastic safety cover to the wiring terminal block.

Step 3   Using the 10-mm socket wrench, remove the three positive and three negative cables from the terminal block.

Step 4   Using the 10-mm socket wrench, remove the ground cable from the ground cable terminal.

✎

Note   When a cable is removed from the rear of the fixed configuration DC power shelf, we recommend that it should be wrapped with standard black electrical tape.

Step 5   Reattach the upper plastic safety cover with a Phillips screwdriver. Insert and tighten the four screws holding the cover to the wiring terminal block.

Installing a DC PEM or AC Rectifier

This section describes how to install a DC PEM or AC rectifier in the Cisco CRS 8-slot line card chassis. For information on the difference between the power types, see the "DC Power Systems" section on page 2-6 and the "AC Power Systems" section on page 2-11.

The DC PEM or AC rectifier is installed into the front of the chassis, and mates with the PDU that is installed on the back of the chassis (see the "Installing a PDU" section on page 2-15 for information). Although there are differences among the different DC PEM or AC rectifiers (AC Wye, AC Delta, and DC), they are installed in the same manner. (Figure 2-12 shows an AC Wye rectifier for reference.)

Figure 2-12   Fixed Configuration AC Wye Rectifier
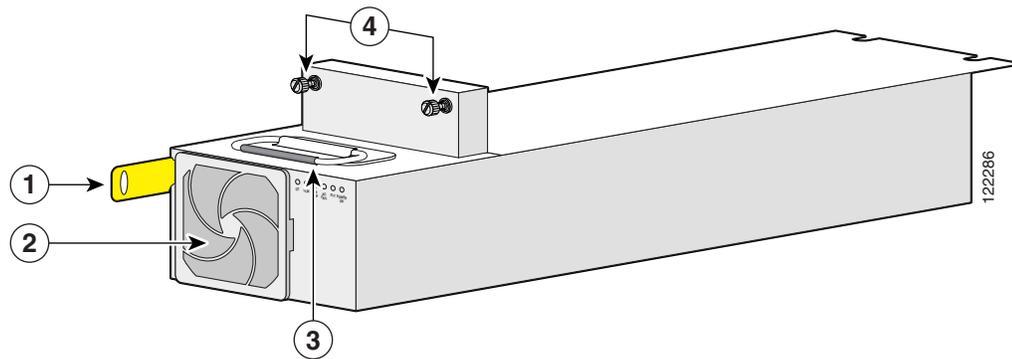
1	Power switch	3	Handle
2	Module air filter	4	Captive screws

Prerequisites

Before performing this task, make sure that the PDU has been installed (see the "Installing a PDU" section on page 2-15) and remove any cosmetic covers.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver
- Fixed configuration power module
  - AC rectifier Cisco product number CRS-8-AC-RECT=
  - DC PEM Cisco product number CRS-8-DC-PEM=

Steps

To install a DC PEM or AC rectifier, perform the following steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2 Make sure that the power switch is in the off position.

Step 3 Grasp the handle on the top of the module firmly, and lift it partway up.

Step 4 Using two hands to support and guide the DC PEM or AC rectifier, slide it into the chassis power bay on the front (PLIM) side of the chassis until the connector on the back of the module meets the connector on the backplane of the PDU.

⚠️

Caution   An AC rectifier weighs 36 lbs (13.44 kg); a DC PEM weighs 38 lbs (17.24 kg). You should use both hands when handling a DC PEM or AC rectifier.

Step 5 Press the DC PEM or AC rectifier in firmly to seat it against the PDU.

⚠️

Caution   To prevent damage to the PDU-to-module connections, do not use excessive force when seating a DC PEM or AC rectifier to its PDU.

Step 6 Tighten the two captive screws on the face of the DC PEM or AC rectifier to seat it snugly against the PDU.

Step 7 Push the power tab at the bottom front of the module in to the on position.

What to Do Next

After performing this task, you may connect the PDU to the power source (see the "DC Power Systems" section on page 2-6 and the "AC Power Systems" section on page 2-11) and power up the chassis (see the "How to Install or Remove Fixed Configuration Power Components" section on page 2-13).

Removing a DC PEM or AC rectifier

This section describes how to remove a DC PEM or AC rectifier from the Cisco CRS 8-slot line card chassis in a fixed configuration power system. For information on the difference between the power types, see the "DC Power Systems" section on page 2-6 and the "AC Power Systems" section on page 2-11.

The DC PEM or AC rectifier is located on the front of the chassis, and mates with the PDU that is installed on the back of the chassis (see the "Installing a PDU" section on page 2-15 for information). Although there are differences among the DC PEMs or AC rectifiers (AC Wye, AC Delta, and DC), they are removed in the same manner. (Figure 2-13 shows an AC Wye rectifier for reference.)

Figure 2-13   Fixed Configuration AC Wye Rectifier
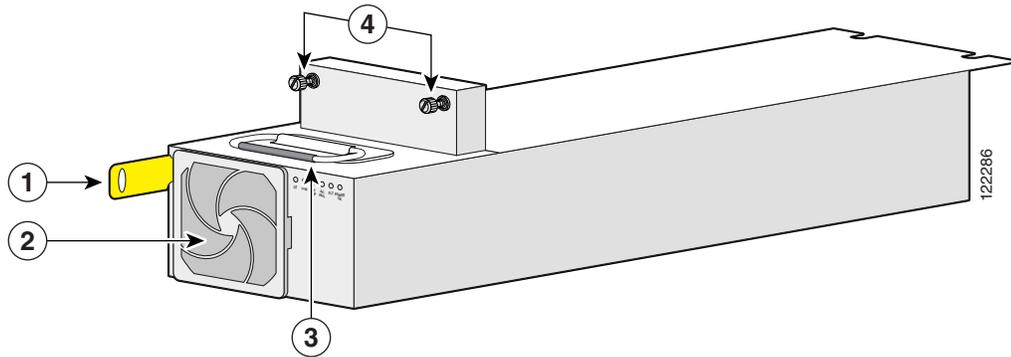
1	Power switch	**3**	Handle
2	Module air filter	**4**	Captive screws

Prerequisites

Before performing this task, make certain that the PDU has been installed and any cosmetic covers removed.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver

Steps

To remove a DC PEM or AC rectifier, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   On the front side of the chassis, pull the power tab on the bottom front of the DC PEM or AC rectifier out to the off position.

Step 3   Use the screwdriver to loosen the two captive screws on the front of the DC PEM or AC rectifier.

Step 4   Grasp the DC PEM or AC rectifier handle and pull the DC PEM or AC rectifier halfway from the bay. Be sure to pull the module by the handle only.

⚠

Caution   Take care when handling a DC PEM or AC rectifier that has been recently used—it can be hot to the touch.

> ⚠ **Caution**   An AC rectifier weighs 36 lbs (13.44 kg); a DC PEM weighs 38 lbs (17.24 kg). You should use both hands when handling a DC PEM or AC rectifier.

Step 5   Use your free hand to support the DC PEM or AC rectifier while you slide the module completely from the bay, then set the module safely aside.

What to Do Next

After performing this task, you may install a new DC PEM or AC rectifier, if needed (see the "Installing a DC PEM or AC Rectifier" section on page 2-22), and replace any front cosmetic covers.

How to Install or Remove Modular Configuration Power Components

This section describes how to install and remove modular configuration power components in the Cisco CRS Carrier Routing System 8-Slot line card chassis.

Before you install the modular configuration power components, you must install the modular configuration power shelf into the chassis. After installing the power shelf, you can install the AC or DC PMs into the power shelf.

> ✎ **Note**   Although there are differences between the different types of modular configuration power shelves and PMs (AC and DC), they are installed and removed using the same procedures.

If you are replacing a fixed configuration power supply with a modular configuration power supply, you must change the entire power shelf before you can install the power components. For more information, refer to the "Converting a Chassis from Fixed Configuration Power to Modular Configuration Power" section on page 2-54.

This section contains the following procedures:

- Installing a Modular Configuration Power Shelf, page 2-26
- Installing AC Power Cords or DC Power Shelf Wiring, page 2-35
- Installing AC or DC PMs, page 2-40
- Removing AC or DC PMs, page 2-42
- Removing AC Power Cords or DC Power Shelf Wiring, page 2-45
- Removing a Modular Configuration Power Shelf, page 2-48
- Power Up and Power Down a Chassis with a Modular Configuration AC or DC Power Shelf, page 2-51
- Converting from One Modular Configuration Power System to Another, page 2-53

Installing a Modular Configuration Power Shelf

This section describes how to install a modular configuration power shelf.

The modular configuration power shelf is installed into the front of the chassis. Although there are differences between the different power shelf types (AC and DC), they are installed in the same manner.

Note If you have a fixed configuration PDU installed and before you can install a modular configuration power shelf, you must remove the fixed configuration PDU. See "Converting a Chassis from Fixed Configuration Power to Modular Configuration Power" section on page 2-54 for more information.

Figure 2-14 shows the front view of the modular configuration AC power shelf.

Figure 2-14   *Modular Configuration AC Power Shelf, Front View*
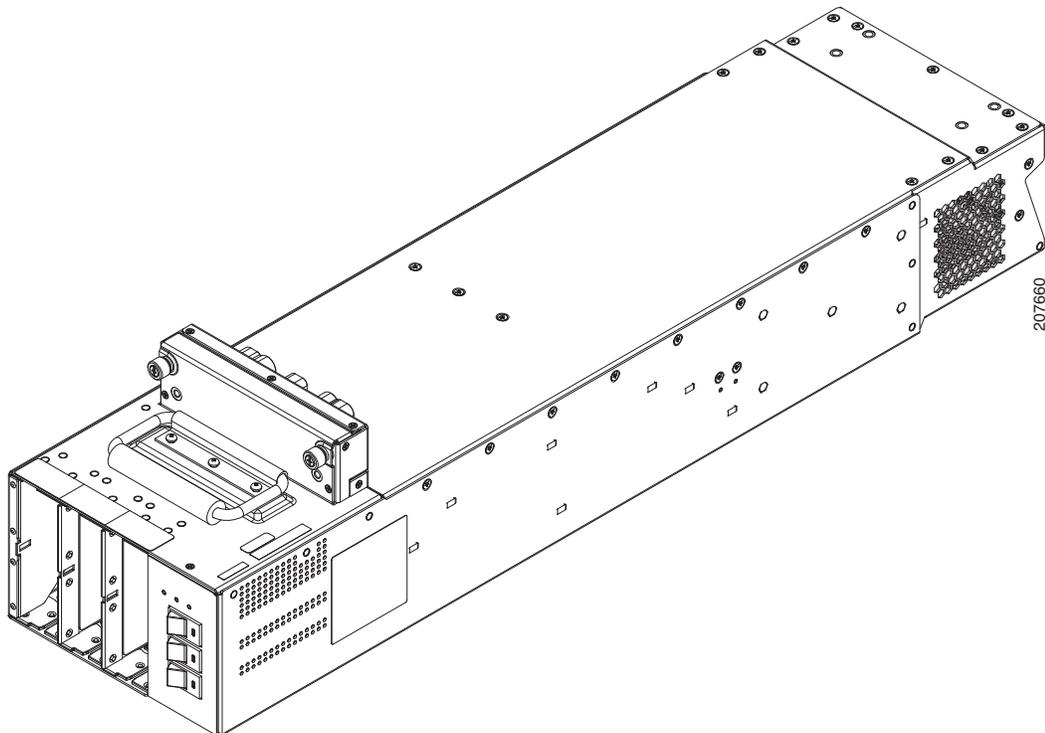
Figure 2-15 shows the rear view of the modular configuration AC power shelf.

Figure 2-15   *Modular Configuration AC Power Shelf, Rear View*
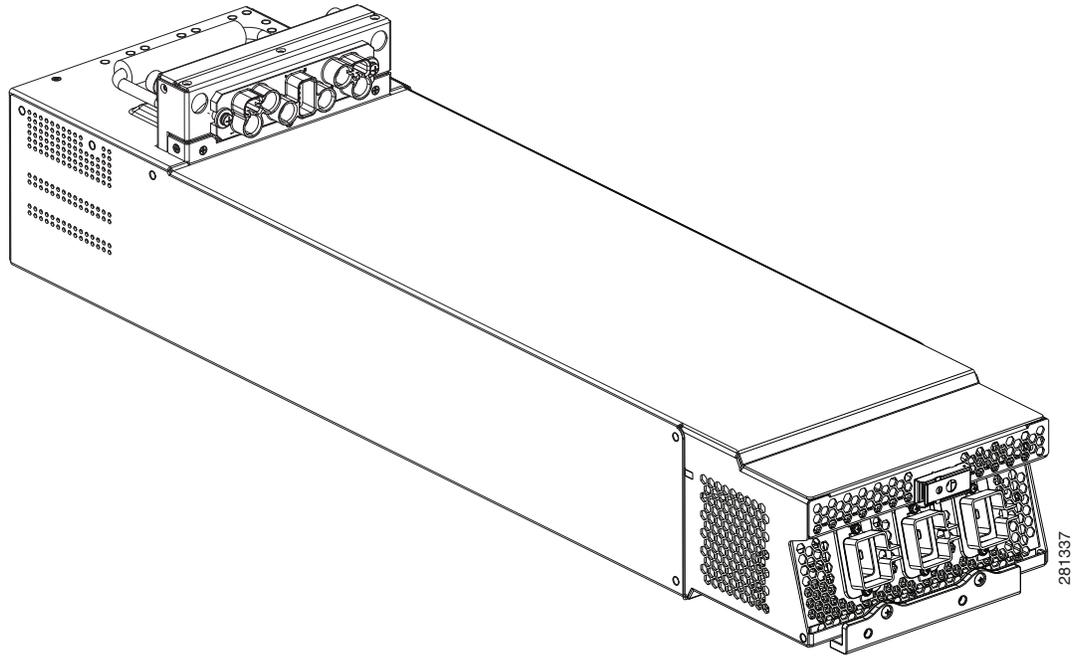
Figure 2-16 and Figure 2-17 show the front and rear views of the modular configuration DC power shelf.

Figure 2-16   *Modular Configuration DC Power Shelf, Front View*
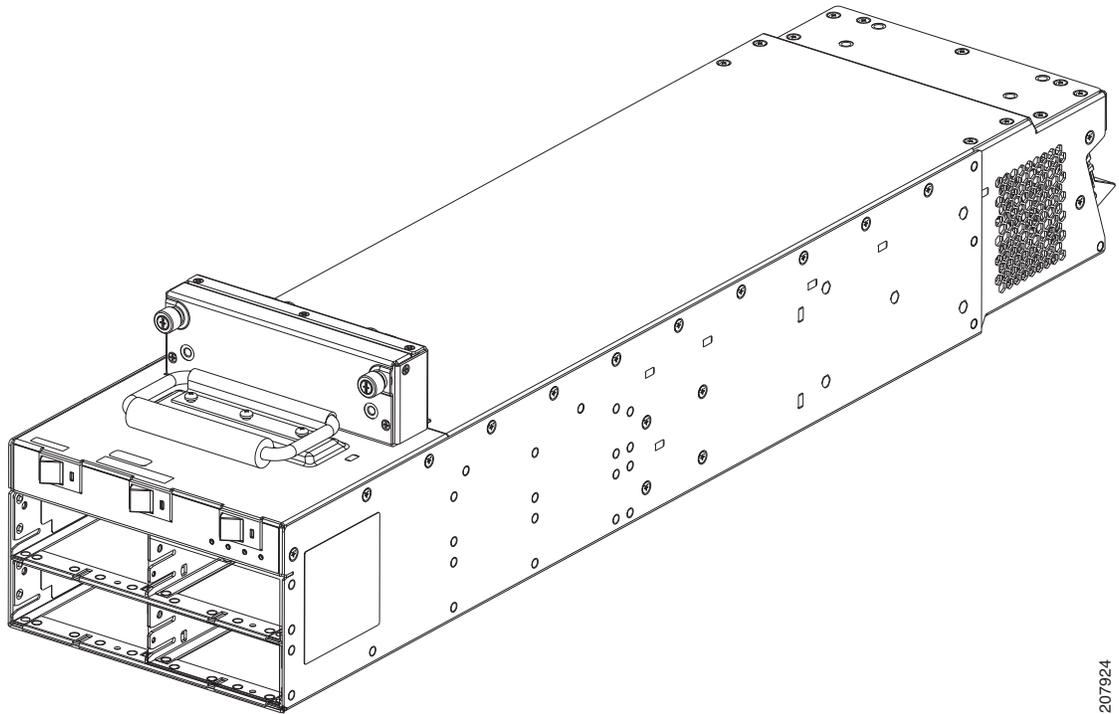
Figure 2-17   *Modular Configuration DC Power Shelf, Rear View*
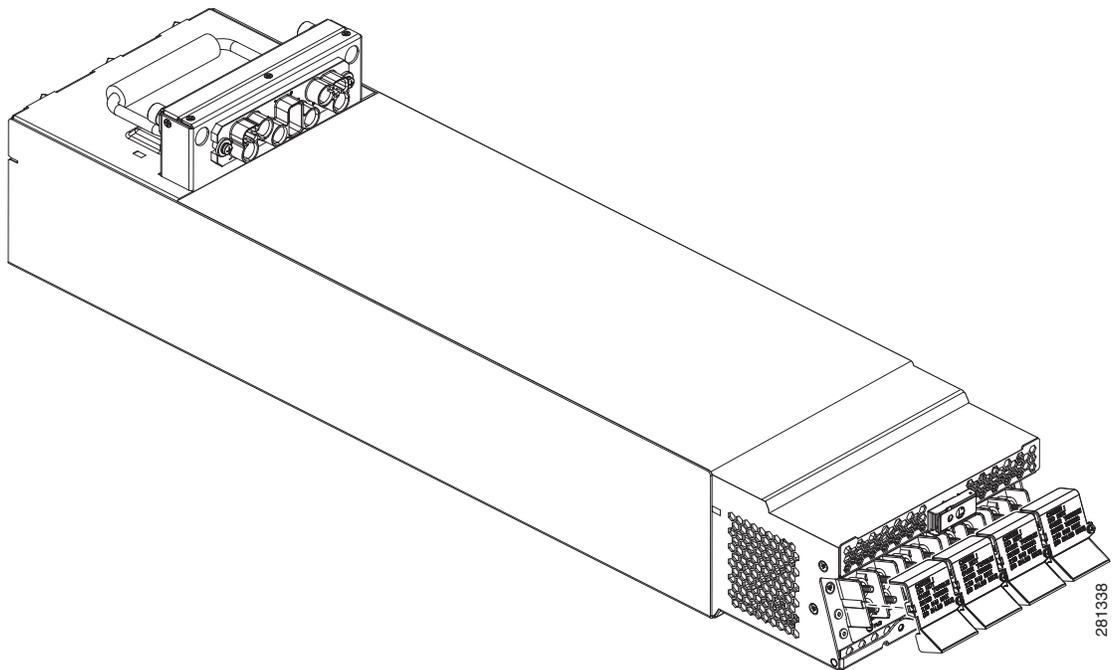
Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver
- 5/32 x 6-in. flat blade screwdriver
- Two 10-mm 6-pt. combination wrenches
- Modular configuration power shelf
  - DC power shelf (Cisco product number CRS-8-PSH-DC=), or
  - AC power shelf (Cisco product number CRS-8-PSH-AC=)

Steps

To install the modular configuration power shelf, go to the rear of the chassis and perform the following steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Ensure that all power cords are disconnected from the power shelf.

Step 3 Remove the power shelf cross bracket from the chassis. See Figure 2-18.

Figure 2-18   *Modular Configuration Power Shelf Cross Bracket*

254849
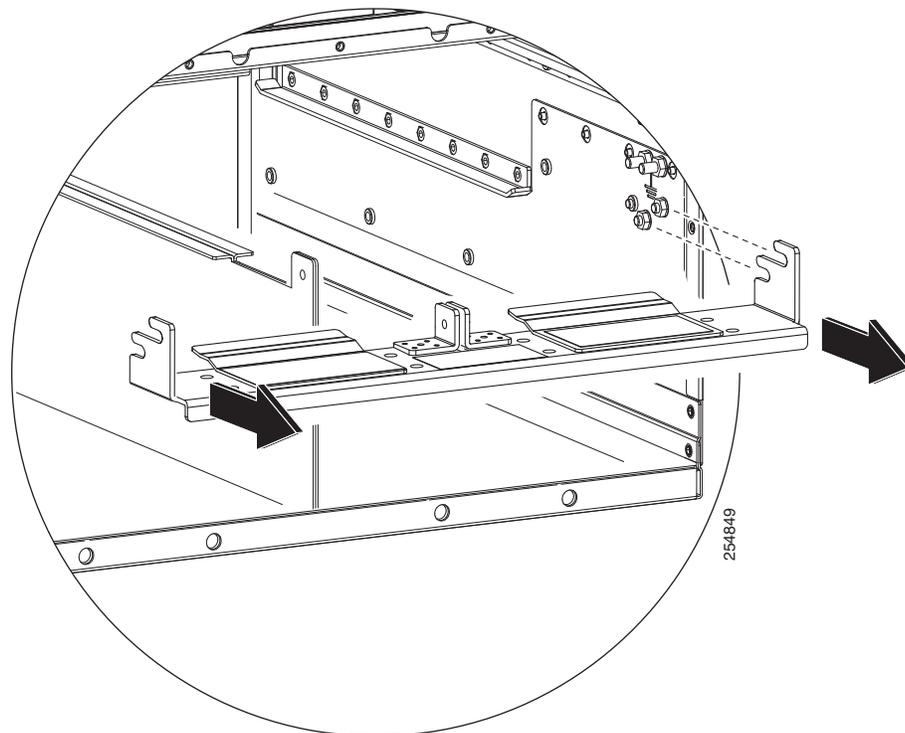
Step 4   Using the flat-blade screwdriver, remove the rear mounting brackets from the power shelves being installed, as shown in Figure 2-19. Set the screws aside in a safe place.

Figure 2-19   *Removing Rear Mounting Bracket from Power Shelf*
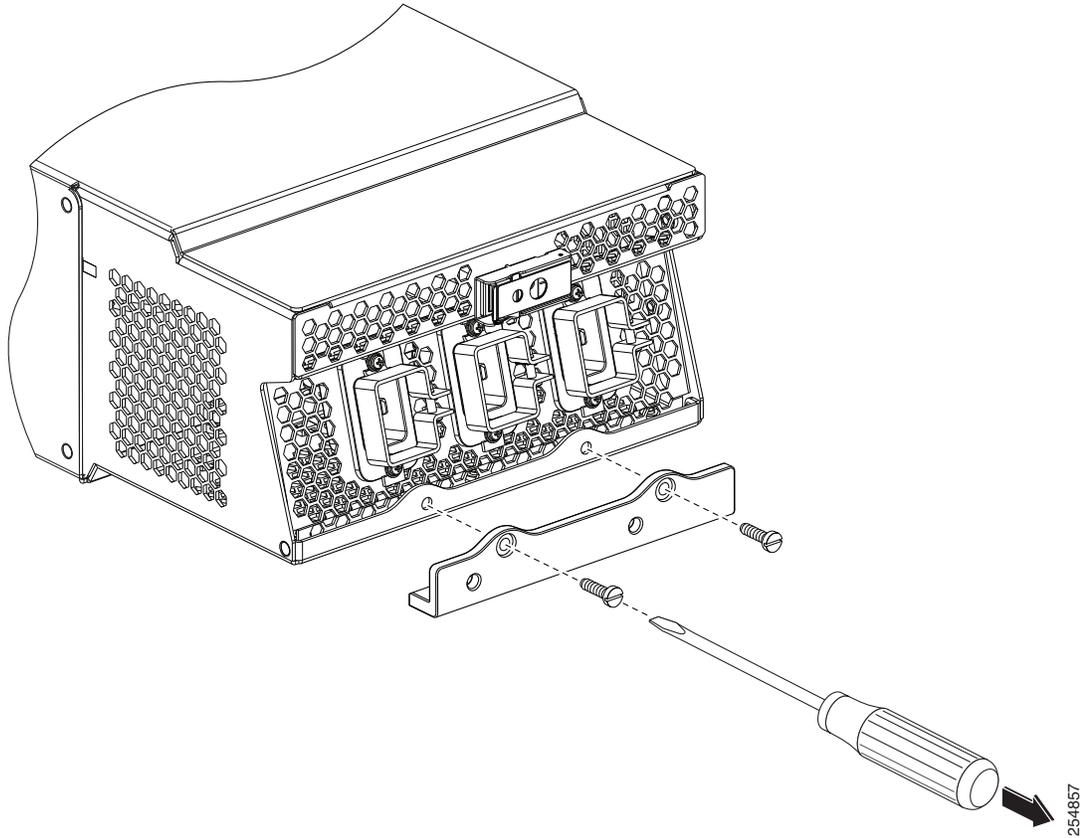
Step 5   Attach the power shelf rear mounting brackets to the chassis, as shown in Figure 2-20.

Figure 2-20   *Attaching Rear Mounting Brackets*
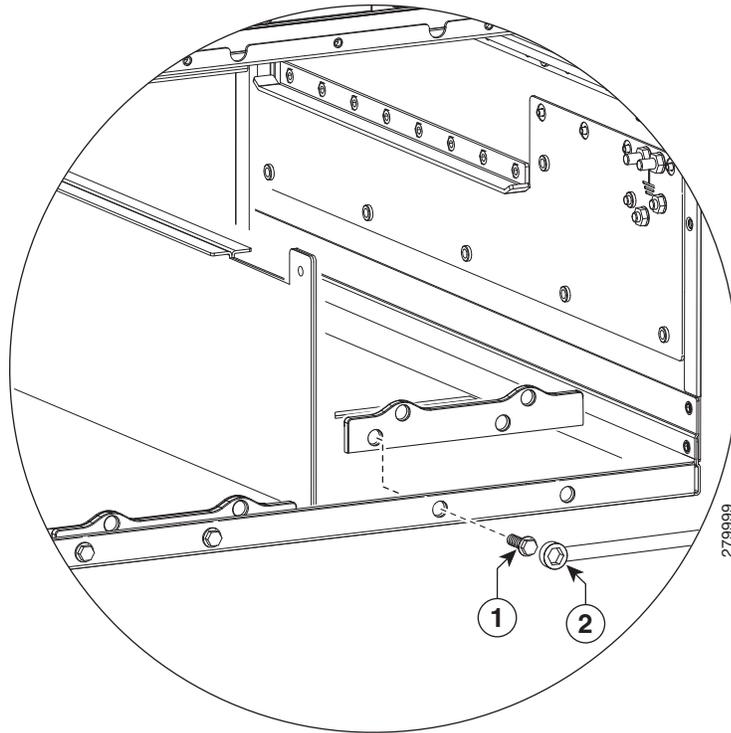
1	Bolts to secure bracket to chassis	**2**	Wrench to tighten bolts

Step 6   Remove the ESD-preventive wrist strap from the rear (MSC) side of the chassis. Go to the front of the chassis and reattach to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 7   Insert the modular configuration power shelf so that it stops against the rear mounting bracket, then fasten the power shelf to the chassis. (There are two screws per shelf, see Figure 2-21).

Figure 2-21   Fastening the Power Shelf to the Chassis
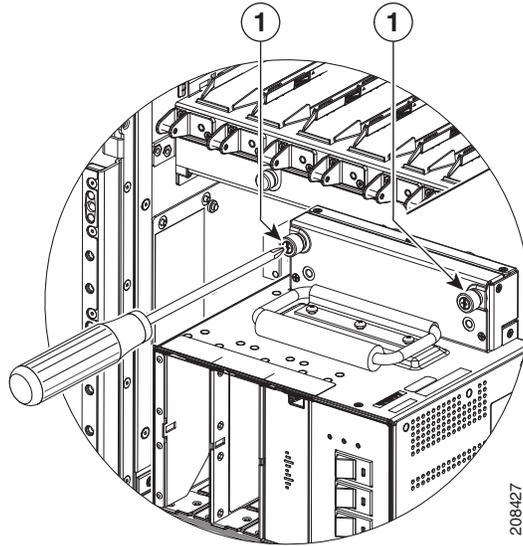
| 1 | Screws to tighten and secure power shelf to chassis. |

Step 8 Remove the ESD-preventive wrist strap from the front (PLIM) side of the chassis. Go to the rear of the chassis and reattach to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 9 Using the 10-mm wrench, install the hex head bolts to secure the power shelf to the cross bracket, as shown in Figure 2-25.

Step 10 Insert the modular configuration power shelf cross bracket on the mounting studs, two on each side of the chassis, as shown in Figure 2-22. Then install the four M6 nuts, two on each chassis side, and tighten with the 10-mm combination wrench as shown in Figure 2-23.

Figure 2-22   Installing Modular Configuration Power Shelf Cross Bracket
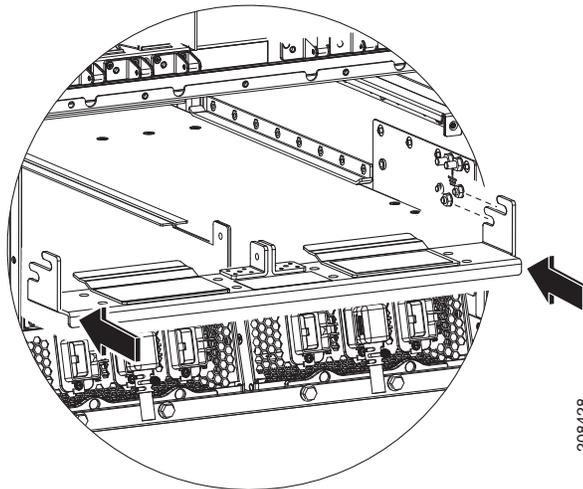
Figure 2-23   Securing Nuts on Mounting Studs
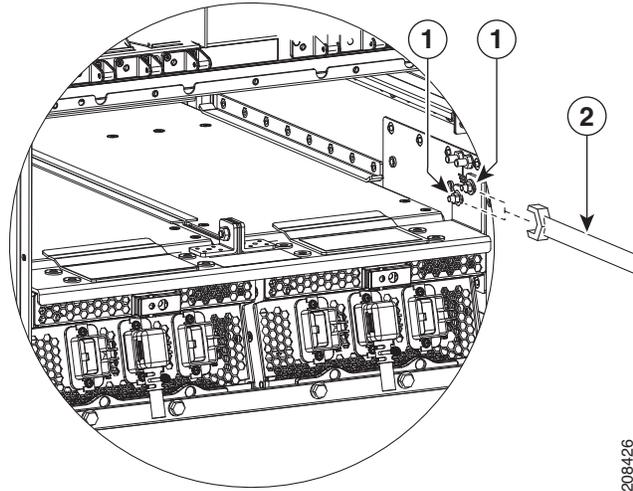
1	M6 hex nuts that secure bracket to chassis (two on each side of the chassis)
2	10-mm wrench to secure hex nuts

Step 11   Using a 10-mm wrench on the bolt side and a 10-mm wrench on the nut side, secure the cross bracket to the chassis. See Figure 2-24.

Figure 2-24   Securing Cross Bracket to Chassis and Power Supply
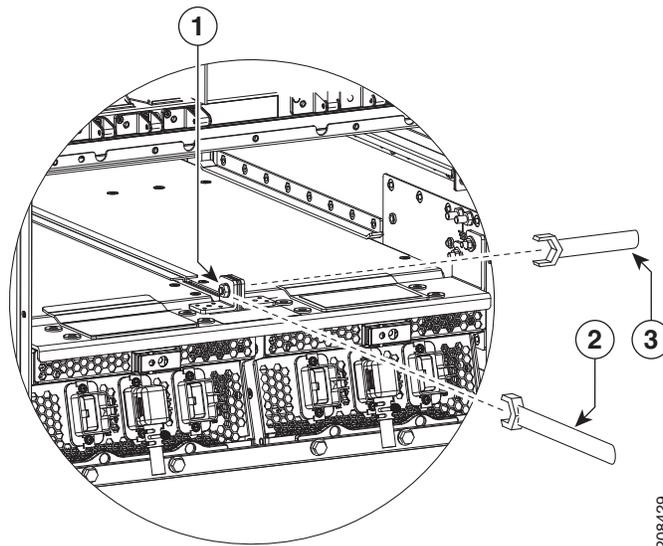
1	M6 nut/bolt to tighten	3	10-mm wrench
2	10-mm wrench		

Step 12 Using the flat-blade screwdriver, install power shelf mounting screws, to secure power shelf to rear mounting bracket. See Figure 2-25.

Figure 2-25   Securing Power Supplies to Cross Bracket and Rear Mounting Brackets
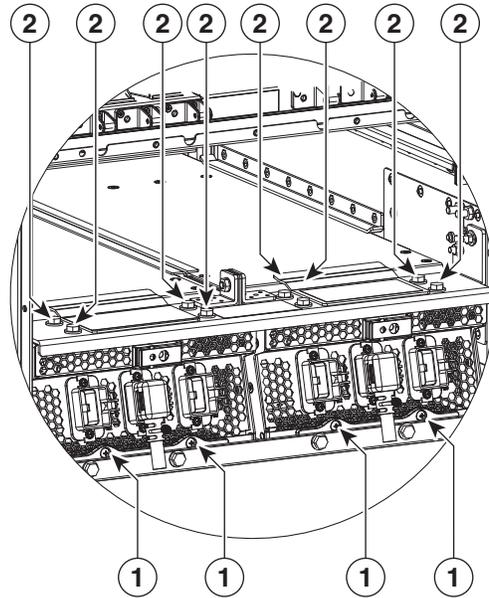
1	Power shelf mounting screws, two slotted screws per shelf
2	M6 hex head bolts to secure power shelf, four per shelf

What to Do Next

After installing the modular configuration power shelf, install the DC input wiring and DC terminal block covers or install the AC cords, as described in "Installing AC Power Cords or DC Power Shelf Wiring" section on page 2-35.

Installing AC Power Cords or DC Power Shelf Wiring

This section describes how to install the DC input wiring, DC terminal block covers and the AC power cords on the Cisco CRS Carrier Routing System 8-Slot line card chassis.

Installing Modular Configuration DC Power Shelf Wiring

This section describes how to wire the modular configuration DC power shelf. For more detailed information on chassis DC power systems, see the "Modular Configuration DC Power" section on page 2-9.

Figure 2-26 shows the power cable connections at the rear of the modular configuration DC power shelf.

Figure 2-26   *Modular Configuration DC Power Shelf Power Cable Connections*
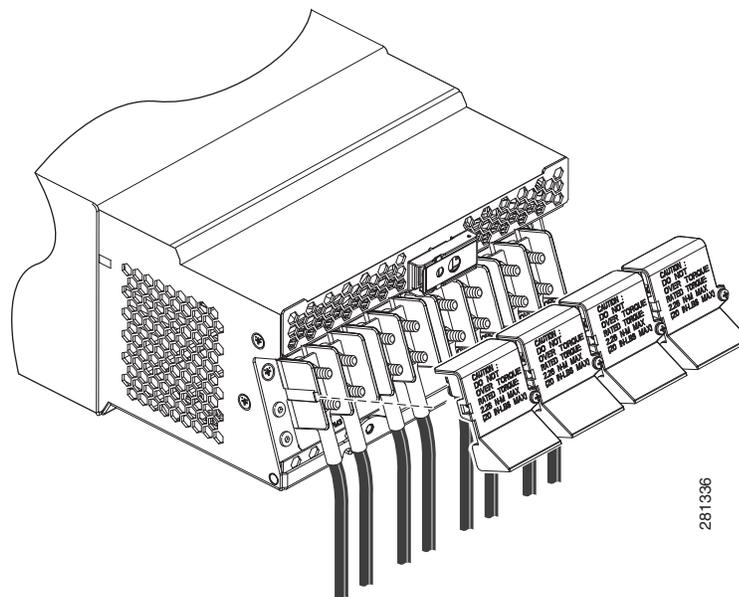
⚠️ **Caution**   When wiring the power shelf, be sure to attach the chassis ground cable to the chassis first and tighten the nuts to a torque of 30 in-lb (3.39 N-m). For more information, see the "Bonding and Grounding Guidelines" section on page 2-4.

Prerequisites

Before performing this task, ensure that both power shelves are installed in the chassis.

⚠

Caution   Before installing wiring on the power shelf, make sure that the input power cables are not energized.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Crimping tool and lug specific die
- 3/8 in. ratchet wrench with 10-mm socket
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 20 in.-lb (2.26 N-m)

Steps

To wire the modular configuration DC power shelf, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Remove the terminal block cover.

Step 3   Use the crimping tool mandated by the lug manufacturer to crimp the lugs to the DC-input cables. For details on lugs, see the "DC Power Systems" section on page 2-6.

The cable should be sized according to local and national installation requirements. Use only copper cable.

✎

Note   The power supply terminal block lug opening width is 0.63 inch (1.60 cm). The terminal posts are centered 0.63 inches (5/8 inch) (1.60 cm) apart and are M6-threaded. We recommend that you use an appropriately sized 180-degree (straight) or 45-degree angle industry standard 2-hole, standard barrel compression lug.

Step 4   Using the 10-mm socket wrench, attach the positive and negative cable pairs to each terminal block. Use the torque wrench to tighten to a torque of 20 in.-lb (2.26 N-m).

⚠

Caution   Make sure that the polarity of the DC input wiring is correct.

Step 5   Reattach the terminal block covers.

Installing DC Terminal Block Covers

Figure 2-27 shows the DC terminal block cover.

Figure 2-27   DC Terminal Block Cover
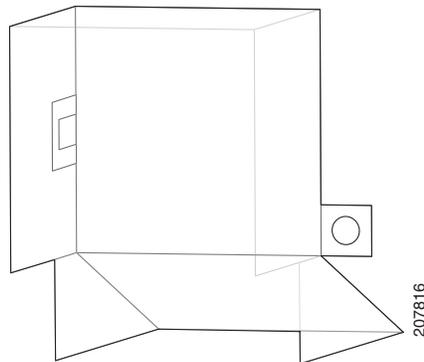
> **Note**   Install the terminal block cover after the input wiring is installed, but before the power is energized.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver

Steps

To install the DC terminal block covers, go to the rear of the chassis and perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Align the DC terminal block cover with the cover latch tab.

Step 3   Use the Phillips screwdriver to secure the screw into the mounting standoff, see Figure 2-28.

Figure 2-28   Securing the DC Terminal Block Cover
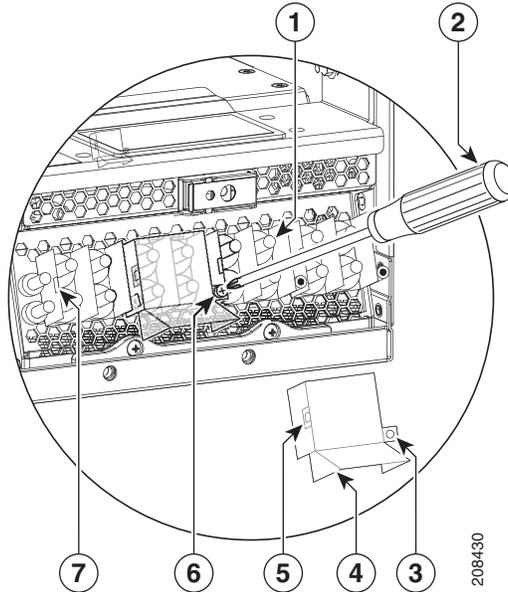
1	Mounting Standoff	5	Opening to align over mounting pins
2	Screwdriver securing the cover	6	Screw to tighten
3	Opening to align over mounting pins	7	Cover latch tab
4	Terminal block cover		

Installing Modular Configuration AC Power Shelf Wiring

This section describes how to install input AC power cords on the modular configuration AC power shelf.

Note   When wiring the power shelf, be sure to connect the chassis ground cable first.

Prerequisites

Before performing this task, ensure that both power shelves are installed in the chassis.

If you have AC Delta or AC Wye at your equipment, a *Cisco CRS PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

Note   Before installing input AC power cords, make sure that the AC power cords are not energized.

Required Tools and Equipment

You need the following tools to perform this task:

- 6-in. long number 1 Phillips screwdriver

Note   You can use an offset number 1 Phillips screwdriver to tighten the AC cord clamp that was available pre-June 2011, but this is optional. An offset screwdriver is not required to tighten the AC cord clamp that is available from June 2011 onwards. See Figure 2-29.

Steps

To install the AC cords, go to the rear of the chassis and perform the following steps:

Step 1   Insert the AC cords into the AC cord clamps, as shown in Figure 2-29.

Note   If you have a Cisco CRS PDU installed, the AC cords must be installed as labelled. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

Figure 2-29   Inserting AC Cord into Cord Clamp
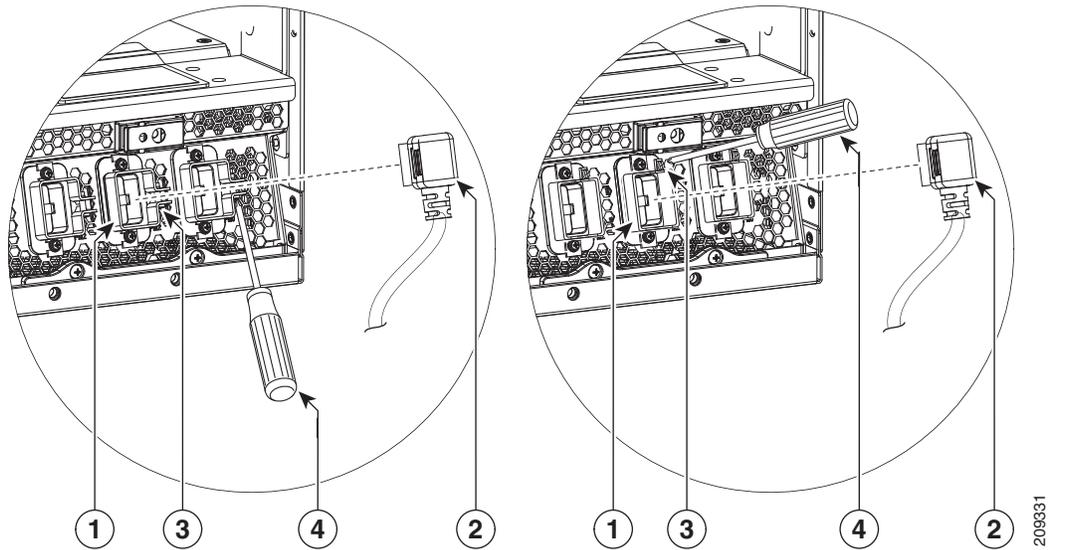
| 1 | Cord clamp | 3 | Screw that secures the cord in clamp |
| 2 | Cord to be inserted into clamp | 4 | Screwdriver that tightens screw |

Note   In Figure 2-29, the AC cord clamp shown on the left was available until June 2011, and the AC cord clamp shown on the right is available from June 2011 onwards. The location of the screw that secures the cord in the cord clamp is different.

Step 2   Use the Phillips screwdriver to tighten the screw that clamps the cord in place, see Figure 2-29.

What to Do Next

After you install the DC wiring and DC terminal block covers or AC input cords, install the AC or DC PMs, as described in "Installing AC or DC PMs" section on page 2-40.

Installing AC or DC PMs

This section describes how to install modular configuration AC or DC PMs.

The modular configuration AC or DC PMs are installed into the front of the chassis. Although there are differences between the AC and DC PMs, they are installed in the same manner.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver
- Torque screwdriver with number 1 Phillips bit and rated accuracy at 5.5 in-lb (0.62 N-m)
- Modular configuration AC or DC PM
    - AC PM (Cisco product number CRS-PM-AC=)
    - DC PM (Cisco product number CRS-PM-DC=)

Steps

To install the AC or DC PMs in the power shelf, go to the front of the chassis and perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Using two hands to support and guide the PM, slide it into the power shelf.

Figure 2-30   *Sliding PM Into Power Shelf*
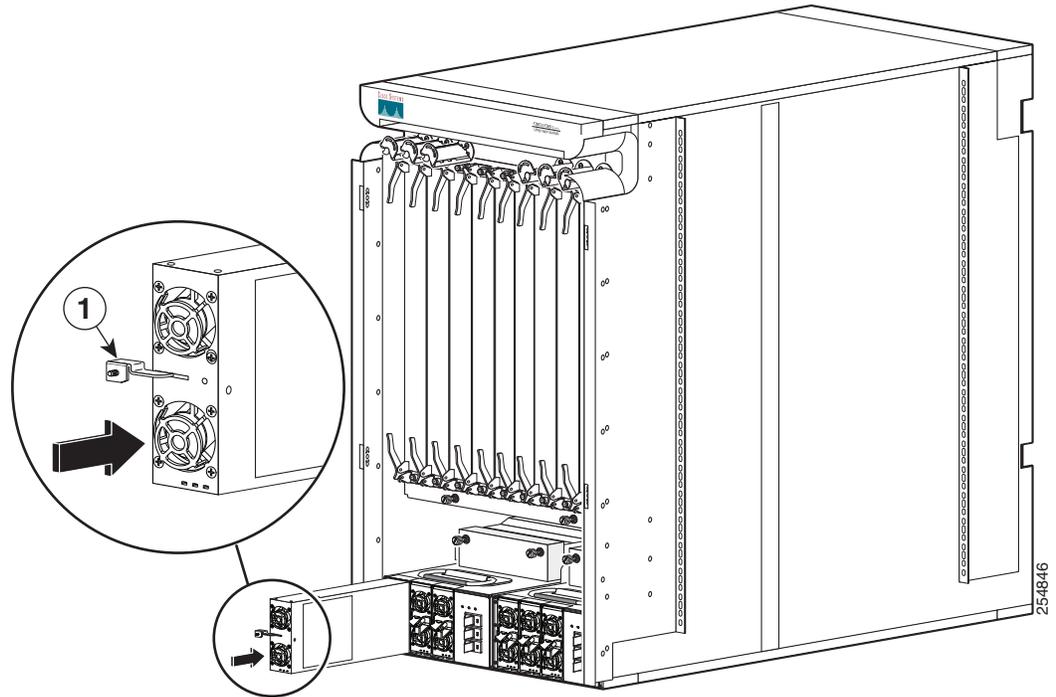
1	Ejector pulled away from the PM.

Step 3   Flip up the ejector and with nominal install torque of 5.5 in-lb (0.62 N m) of torque, screw the PM into the shelf (see Figure 2-30). Do not exceed an install torque value of 10 in-lb (1.13 N-m).

Figure 2-31   Securing the Ejector Into the PM
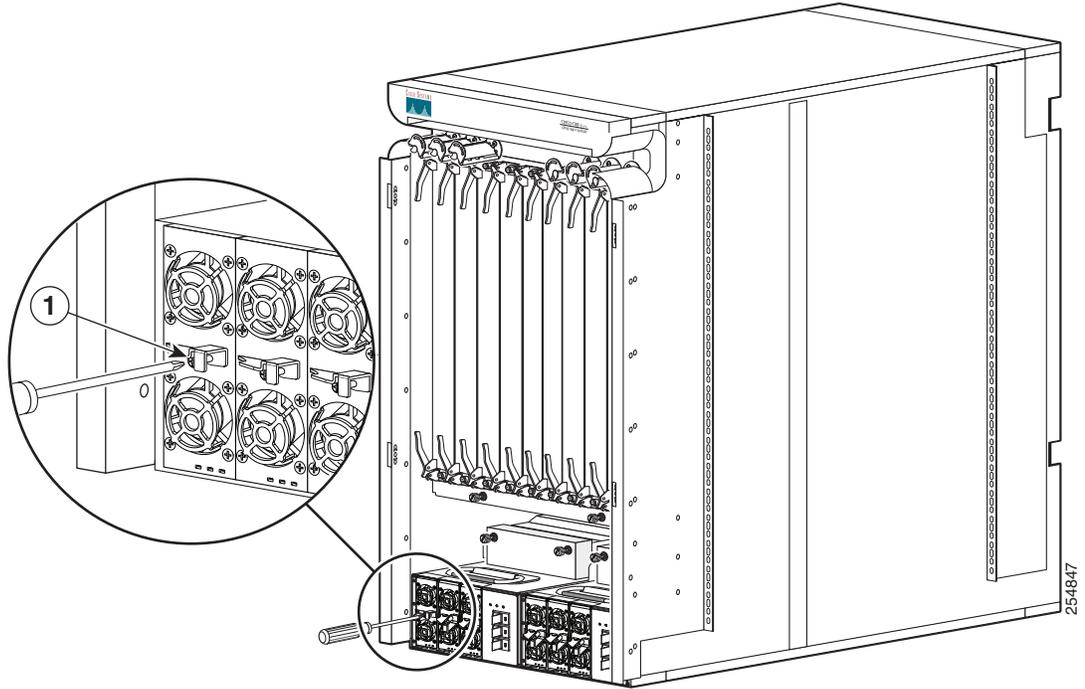
1	Screw the ejector into the PM

Step 4   Install the second PM and fill the power shelf to the required configuration.

What to Do Next

After installing the PMs, you can install the cosmetic covers. For more information, see Chapter 5, "Installing and Removing Exterior Components."

Removing AC or DC PMs

This section describes how to remove AC or DC PMs from the Cisco CRS 8-slot line card chassis.

Note   Although there are differences between the AC and DC PMs, they are removed in the same manner.

Required Tools and Equipment

You need the following tools to perform this task:

* ESD-preventive wrist strap
* 6-in. long number 1 Phillips screwdriver

Steps

To remove the AC or DC PMs, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   At the front of the chassis, unscrew the ejectors from the PMs, as shown in Figure 2-32.

Figure 2-32   Unscrew Ejectors from PM
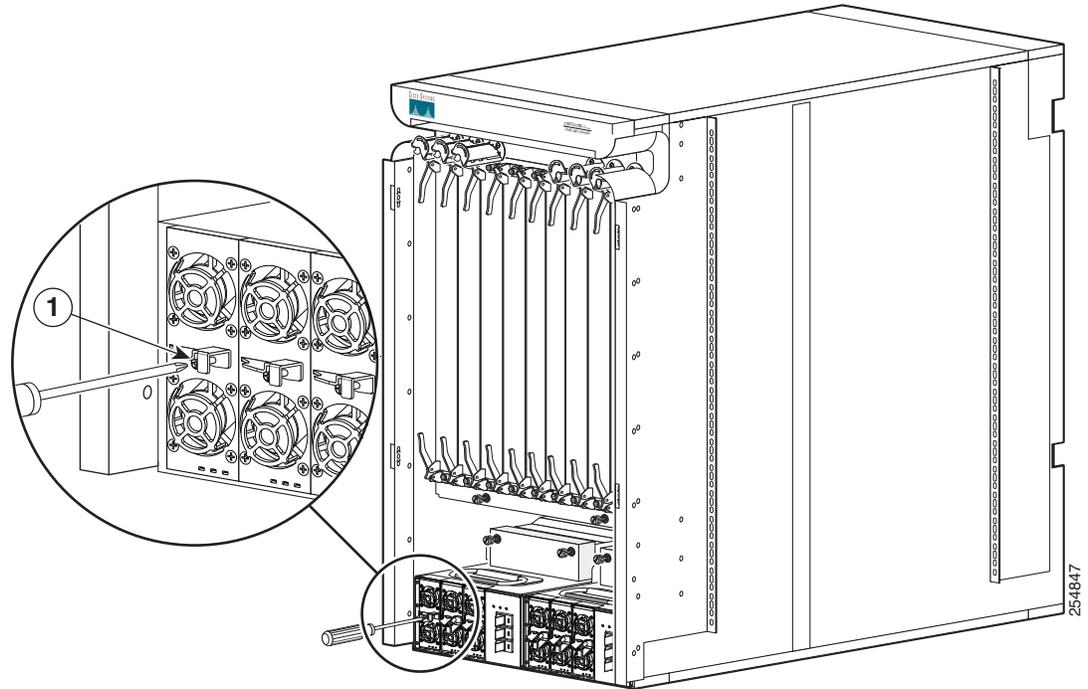
1	Ejector on PM

Step 3   After unscrewing the ejector, carefully slide the PM out of the power shelf, as shown in Figure 2-33.

Figure 2-33   Removing the PM
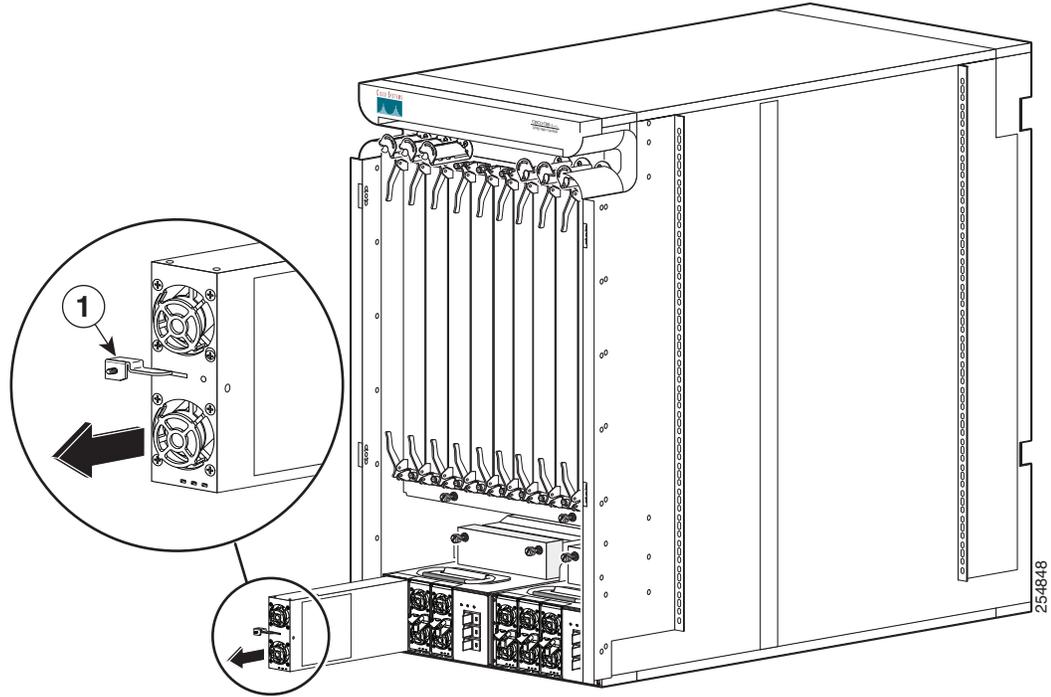
| 1 | Ejector on PM |

What to Do Next

After the PMs have been removed from the chassis, you can remove the power shelf wiring. Continue to for instructions.

# Removing AC Power Cords or DC Power Shelf Wiring

This section describes how to remove the DC input wiring, DC terminal block covers and the AC power cords from the Cisco CRS Carrier Routing System 8-Slot line card chassis.

Removing Modular Configuration DC Power Shelf Wiring

This section describes how to remove the DC wiring from the modular configuration DC power shelf. For more detailed information on chassis DC power systems, see the "DC Power Systems" section on page 2-6.

Figure 2-34 shows the power cable connections at the rear of the modular configuration DC power shelf.

Figure 2-34   Modular Configuration DC Power Shelf Power Cable Connections
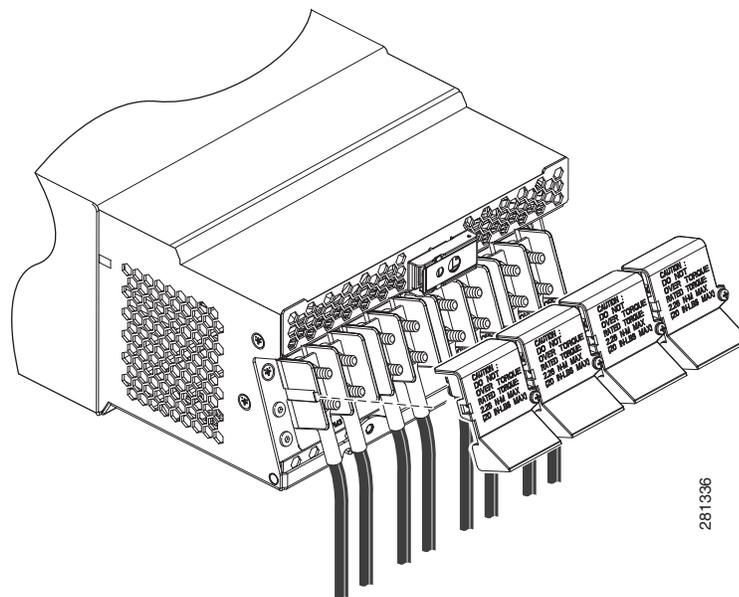
Prerequisites

Before performing this task, power down and remove DC PMs in the shelf you want to disconnect.

Note   Before removing wiring from the power shelf, make sure that the input power cables are not energized.

Required Tools and Equipment

You need the following tools to perform this task:

*   ESD-preventive wrist strap
*   6-in. long number 1 Phillips screwdriver
*   10-mm socket wrench

Steps

To remove the wiring from the modular configuration DC power shelf, perform the following steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Use the screwdriver to remove the screw that secures the terminal block cover into the mounting standoff, see Figure 2-35.

Figure 2-35   *Removing the DC Terminal Block Cover*
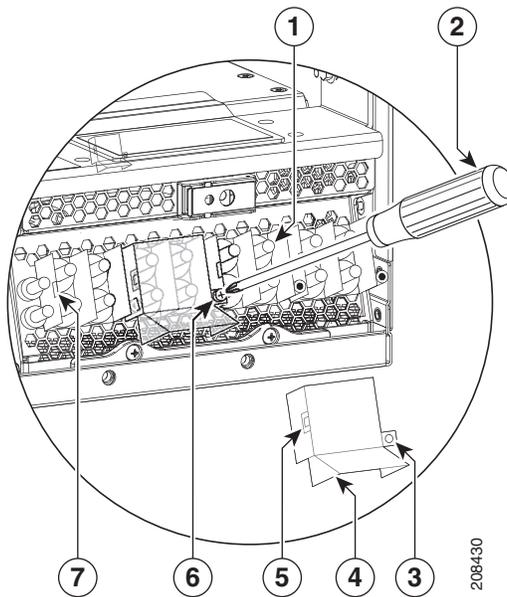
1	Mounting Standoff	5	Opening that aligns over mounting pins
2	Screwdriver removing the cover	6	Screw to remove
3	Opening that aligns over mounting pins	7	Cover latch tab
4	Terminal block cover		

Step 3 Remove the terminal block cover.

Step 4 Using the 10-mm socket wrench, remove the positive cables from the terminal block.

Step 5 Using the 10-mm socket wrench, remove the negative cables from the terminal block.

Note   When a cable is removed from the rear of the modular configuration DC power shelf, we recommend that it should be wrapped with standard black electrical tape.

Step 6 Reattach the terminal block cover.

Removing Modular Configuration AC Power Shelf Wiring

This section describes how to remove input AC cords from the modular configuration AC power shelf.

Prerequisites

Before performing this task, power down and remove AC PMs in the shelf you want to disconnect.

Note   Before removing wiring from the power shelf, make sure that the input power cables are not energized.

Required Tools and Equipment

You need the following tools to perform this task:

- 6-in. long number 1 Phillips screwdriver

Note   You can use an offset number 1 Phillips screwdriver to tighten the AC cord clamp that was available pre-June 2011, but this is optional. An offset screwdriver is not required to tighten the AC cord clamp that is available from June 2011 onwards. See Figure 2-36.

Steps

To remove the input AC cords, go to the rear of the chassis and perform the following steps:

Step 1   Use the screwdriver to loosen the screw that clamps the cord in place, see Figure 2-36.

Step 2   Remove the cord from the cord clamp, as shown in Figure 2-36.

Figure 2-36   Removing Cord from Cord Clamp
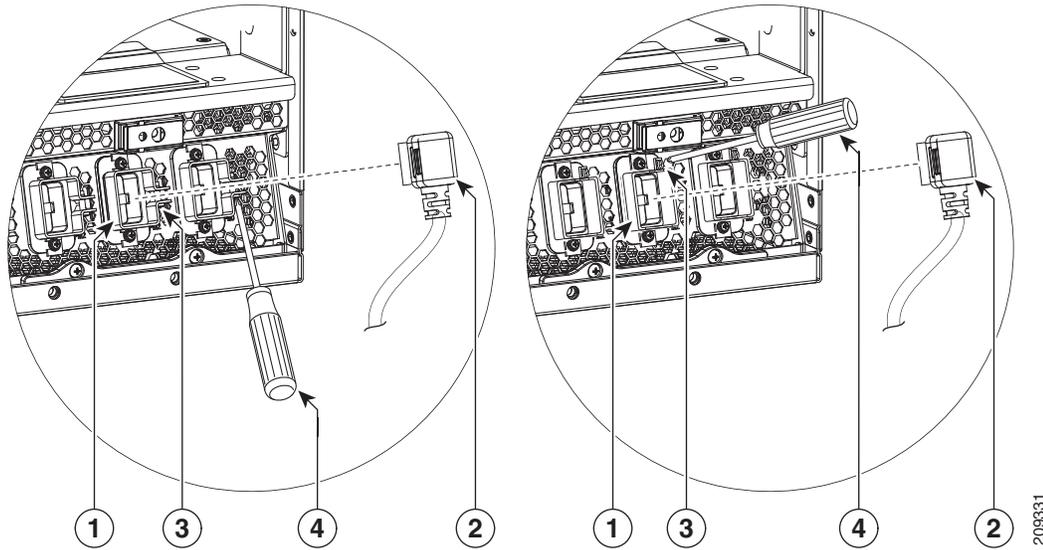
1	Cord Clamp	**3**	Screw that secures the cord in clamp
2	Cord removed from clamp	**4**	Screwdriver that loosens screw

Note   In Figure 2-36, the AC cord clamp shown on the left was available until June 2011, and the AC cord clamp shown on the right is available since June 2011. The location of the screw that secures the cord in the cord clamp is different.

What to Do Next

After you remove the DC wiring and DC terminal block covers or AC cords, remove the power shelf. See the "Removing a Modular Configuration Power Shelf" section on page 2-48.

Removing a Modular Configuration Power Shelf

This section describes how to remove a modular configuration power shelf from the Cisco CRS 8-slot line card chassis.

Although there are differences between the AC and DC power shelves, they are removed in the same manner.

Prerequisites

Before performing this task, remove DC input power wiring or AC input cords from the shelf that you want to disconnect. For more information, see the "Removing AC Power Cords or DC Power Shelf Wiring" section on page 2-45.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver
- 5/32 x 6 in. flat-blade screwdriver
- Two 10-mm 6 pt. combination wrenches

Steps

To remove the modular configuration power shelf, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Using a 10-mm wrench, remove the hex head bolts that secure the power shelf to the cross bracket, as shown in Figure 2-38.

Step 3   Using the 10-mm wrench, loosen the nuts that secure the cross bracket to the chassis, as shown in Figure 2-37.

Figure 2-37   Loosening Nuts on Mounting Studs
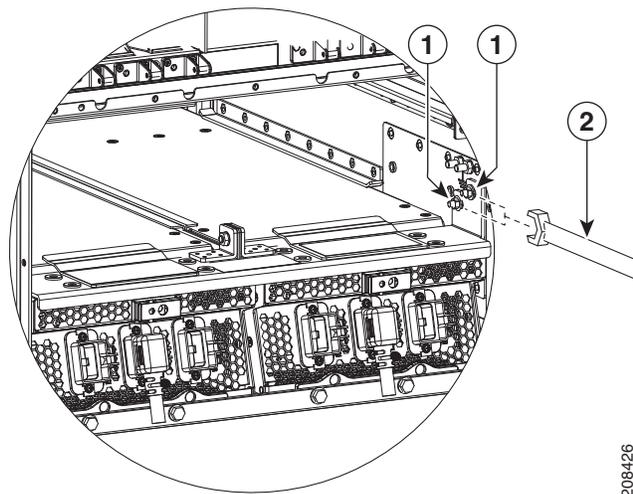
1	M6 hex nuts that secure cross bracket to chassis (two on each side of the chassis)
2	10-mm wrench to loosen hex nuts

Step 4   Using the flat-blade screwdriver, remove the power shelf mounting screws, as shown in Figure 2-38.

Figure 2-38   Securing Power Supplies to Cross Bracket to Rear Mounting Brackets
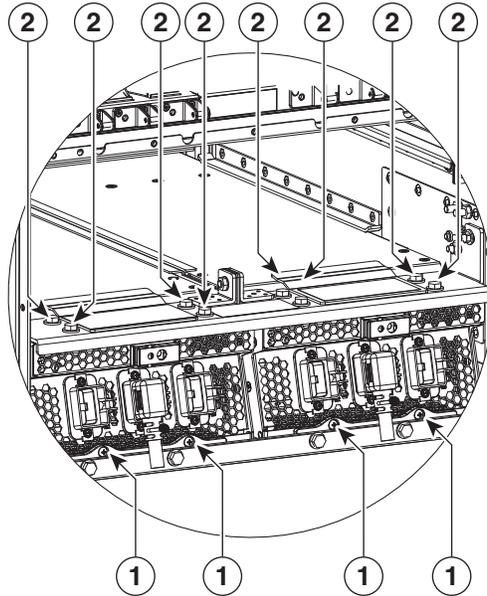
1	Power shelf mounting screws, two slotted screws per shelf
2	M6 Hex head bolts to secure power shelf, four per shelf

Step 5   Using a 10-mm wrench on the bolt side and a 10-mm wrench on the nut side, remove the nut and bolt that secure the cross bracket to the chassis. See Figure 2-39. Remove the cross bracket from the mounting studs.

Figure 2-39   Removing Cross Bracket Nut and Bolt
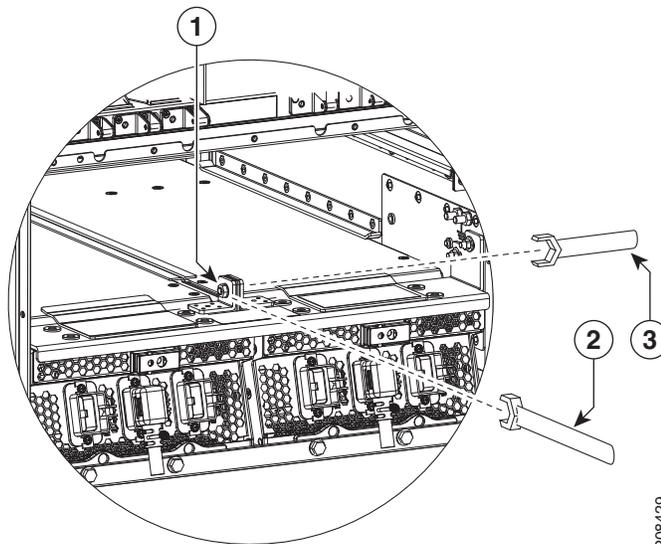
1	Nut/bolt to remove	2	10-mm wrench	3	10-mm wrench

Step 6   Remove the ESD-preventive wrist strap from the rear (MSC) side of the chassis. Go to the front of the chassis and reattach to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 7   Remove the screws, two per shelf, that secure the power shelf to the chassis. Carefully remove the power shelf. See Figure 2-40.

Figure 2-40   Removing Screws that Secure Shelf to Chassis
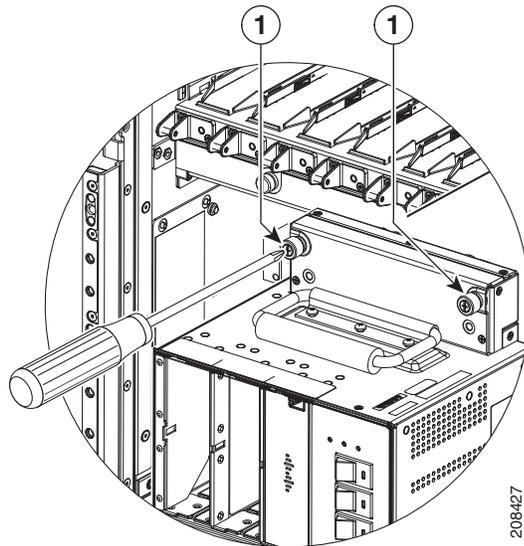
1	Screws that secure power shelf to chassis.

What to Do Next

After performing this task, replace any front (PLIM) side cosmetic covers.

Power Up and Power Down a Chassis with a Modular Configuration AC or DC Power Shelf

This section describes how to power up and power down a chassis with a modular configuration AC or DC power shelf. For details on the chassis power systems, see the "Basic Chassis Power Details" section on page 2-2, the "DC Power Systems" section on page 2-6, and the "AC Power Systems" section on page 2-11.

Most components on the chassis, such as the PMs and fan trays, can be removed or installed in the chassis while it is running. Although it is possible to install or remove a power shelf while the chassis is running, it is recommended to remove power from the chassis completely, if possible, for service protection and safety.

Power Up a Chassis with a Modular Configuration AC or DC Power Shelf

This section describes how to power up a chassis with a modular configuration AC or DC power shelf.

Prerequisites

Before performing this task, you must install the power shelves, wire the power shelves, install the PMs, and install the route processor (RP) card. See the "Installing a Modular Configuration Power Shelf" section on page 2-26, the "Installing AC Power Cords or DC Power Shelf Wiring" section on page 2-35the "Installing AC or DC PMs" section on page 2-40, and the "Installing an RP, PRP, or DRP Card" section on page 4-38 for more information.

Steps

To power up the chassis, perform the following steps:

Step 1   Turn the facility breaker for both power shelves (Power A and Power B) to the ON position.

Step 2   Turn the power shelf power output breakers to the ON position.

> ✎
> **Note**   There is no required order in which you must turn on the power shelves.

Power Down a Chassis with a Modular Configuration AC or DC Power Shelf

This section describes how to power down a chassis with a modular configuration AC or DC power shelf.

Prerequisites

Before performing this task, you must ensure that the system software has been shut down.

Steps

To power down the chassis, perform the following steps:

Step 1   Turn the power shelf power output breakers to the OFF position.

> ✎
> **Note**   There is no required order in which you must turn off the power shelves.

Step 2   Turn the facility breaker for both power shelves (Power A and Power B) to the OFF position.

> ✎
> **Note**   To power down the chassis entirely, both power shelves must be disconnected to de-energize the chassis completely.

Table 2-1 shows the LED status indicator lights for the AC and DC PMs in a modular configuration power supply.

Table 2-1   PM LED Status Indicator Lights—Modular Configuration Power

LED Name	Color	Function or Meaning
Input_OK	Green	On: The input voltage is present and within regulation range.
		Blinking: The input voltage is present but out of regulation range.
		Off: The input voltage is not present.
Output_OK	Green	On: The output voltage is on.
		Blinking: The PM is in a power limit or an OC condition.
		Off: The output voltage is off.
Fault	Red	On: An internal fault is detected within the PM.
		Off: The PM has no internal fault.

Converting from One Modular Configuration Power System to Another

To convert a Cisco CRS 8-slot line card chassis with a modular configuration power system from AC to DC power, or from DC to AC power, perform the following steps:

Step 1   Power down the chassis completely.

Step 2   Remove the AC or DC PMs from the power shelves. See the "Removing AC or DC PMs" section on page 2-42,

Step 3   Remove the AC or DC wiring from the rear of the power shelves. See the "Removing AC Power Cords or DC Power Shelf Wiring" section on page 2-45.

Step 4   Remove the power shelves. See the "Removing a Modular Configuration Power Shelf" section on page 2-48.

Step 5   Install the new power shelves. See the "Installing a Modular Configuration Power Shelf" section on page 2-26.

Step 6   Install the power shelf wiring. See the "Installing AC Power Cords or DC Power Shelf Wiring" section on page 2-35.

> **Note**   If you are converting from modular configuration DC to modular configuration AC power, and if you have 3-phase AC Delta or AC Wye power at your equipment, a *Cisco CRS PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

Step 7   Install the AC or DC PMs. See the "Installing AC or DC PMs" section on page 2-40.

Step 8   Power the chassis back up. See the "Power Up and Power Down a Chassis with a Modular Configuration AC or DC Power Shelf" section on page 2-51.

⚠

Caution Use only one type of modular configuration power shelf—AC or DC—and its mating AC or DC PM in a chassis at one time.

Converting a Chassis from Fixed Configuration Power to Modular Configuration Power

⚠

Caution Do not attempt to convert from fixed configuration power to modular configuration power while the Cisco CRS 8-slot line card chassis is powered up and running. Ensure that you have powered down the system and all power is disconnected from the system.

This section lists the steps to be performed to convert the Cisco CRS 8-Slot line card chassis from fixed configuration power to modular configuration power.

To convert a Cisco CRS 8-slot line card chassis from fixed configuration power to modular configuration power, you must:

Step 1 Power down the chassis completely.

Step 2 Remove the DC PEMs or AC rectifiers. See the "Removing a DC PEM or AC rectifier" section on page 2-23.

Step 3 For fixed configuration DC only, first remove the DC wiring, and then the ground cable from the rear of the PDUs. See the "Removing DC PDU Wiring" section on page 2-21.

Step 4 Remove the PDUs. See the "Removing a PDU" section on page 2-17.

Step 5 Install the new modular configuration power shelf. See "Installing a Modular Configuration Power Shelf" section on page 2-26.

✎

Note Do not connect ground cables directly to a modular configuration power shelf. For more information, see the "Bonding and Grounding Guidelines" section on page 2-4.

Step 6 Install the power shelf wiring. See the section "Installing AC Power Cords or DC Power Shelf Wiring" section on page 2-35.

✎

Note If you are converting from fixed configuration AC or DC power to modular configuration AC power, and if you have 3-phase AC Delta or AC Wye power at your equipment, a *Cisco CRS PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*.

Step 7 Install the PMs. See the section "Installing AC or DC PMs" section on page 2-40.

Step 8 Power the chassis back up. See the "Power Up and Power Down a Chassis with a Modular Configuration AC or DC Power Shelf" section on page 2-51.

Installing and Removing Air Circulation Components

This chapter provides instructions on how to install and replace the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis air circulation components.

This chapter presents the following topics:

- About Line Card Chassis Airflow, page 3-1
- How to Install or Remove Air Circulation Components, page 3-2

About Line Card Chassis Airflow

The Cisco CRS 8-slot line card chassis has two fan trays, each with four fans, that cool the chassis card cages.

The top fan pulls air into the lower portion of the front of the chassis, up across the cards in the front of the chassis, and through the upper fan tray. Air flows out of the upper fan tray and down across all the modular service cards and switch fabric cards through the lower fan tray; air is then exhausted out the bottom of the rear of the chassis (see Figure 3-1).

In addition, each AC or DC power module at the bottom of the chassis has self-contained fans that pull in cool air from the front of the chassis and exhaust the warm air out the rear of the chassis.

A replaceable air filter is located on the front of the chassis below the PLIM card cage. Each power module also has a replaceable air filter that attaches to the module at the front (PLIM) side of the chassis. How often the air filters should be replaced depends on the facility environment. In a dirty environment, or when you start getting frequent temperature alarms, you should always check the intake grills for debris, and then check the air filters to see if they need to be replaced.

Note We recommend that you check the air filters once a month. Replace a filter when you notice a significant amount of dust.

Figure 3-1   Airflow Through the Cisco CRS 8-Slot Line Card Chassis
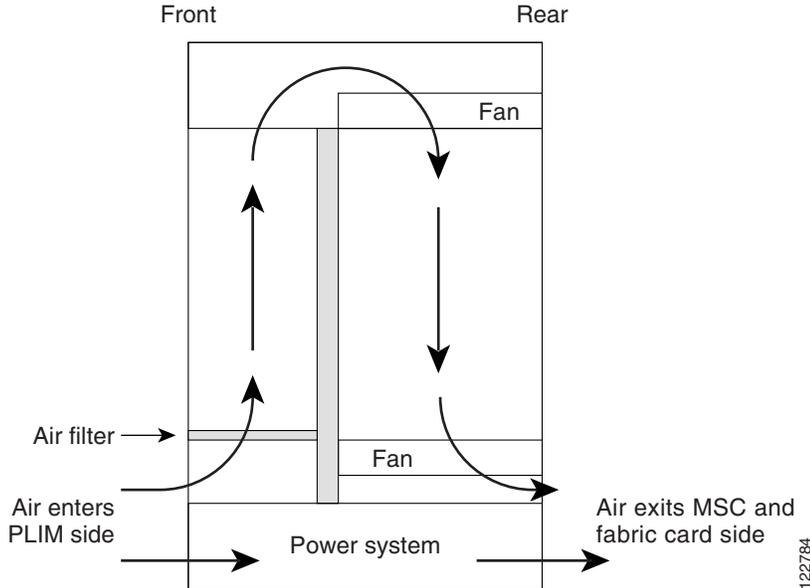
The Cisco CRS 8-slot line card chassis airflow volumes are:

- Chassis airflow: Up to 900 cubic feet (25,485 liters) per minute
- Power system airflow: Up to 240 cubic feet (6,800 liters) per minute

How to Install or Remove Air Circulation Components

This section contains the following procedures:

Installing a Lower Fan Tray

This section describes how to install a fan tray in the lower fan tray slot of the Cisco CRS 8-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System.*

A Cisco CRS 8-slot line card chassis fan tray operates in either the upper or lower fan tray slot. Each fan tray installs into the rear (MSC) side of the chassis (see Figure 3-2). Each fan tray contains four fans.

Figure 3-2   Fan Tray
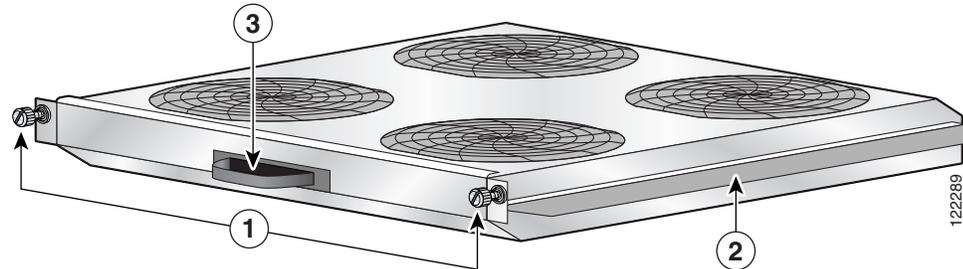
1	Captive screws	**3**	Fan tray handle
2	Fan tray rail		

Prerequisites

Before performing this task, you must first open the chassis doors and remove any front cover plates.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Fan tray (Cisco product number CRS-8-LCC-FAN-TR=)

Steps

To install a lower fan tray, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Using two hands to support the fan tray, position it in front of the fan tray bay so that the rails on the sides of the fan tray are aligned with the rail guides on the interior of the chassis.

⚠

Caution   A fan tray weighs approximately 19.15 pounds (8.69 kg). Use both hands when handling a fan tray.

⚠

Caution   Do not set the fan tray down on the connector; doing so could damage it.

Step 3 Slide the fan tray all the way in. Press it firmly into the chassis so that the connector on the back of the fan tray is seated firmly against the connector on the interior of the chassis.

> ⚠
>
> **Caution**   To prevent damage to the chassis connector, do not use excessive force when inserting a fan tray into its bay.

Step 4 Make sure that the fan tray handle is rotated closed.

Step 5 Using the screwdriver, tighten the two captive screws (one for each side).

> ✎
>
> **Note**   All electrical and control line connections are made automatically when the connectors mate.

What to Do Next

After performing this task, replace the front cover plates.

Installing a Rear Exhaust Screen

This section describes how to install a rear exhaust screen on the Cisco CRS 8-slot line card chassis.

Prerequisites

There are no prerequisites for this task.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large screwdriver
- Rear Exhaust Screen

Steps

To install a rear exhaust screen, follow these steps:

Figure 3-3   *Install rear exhaust screen*
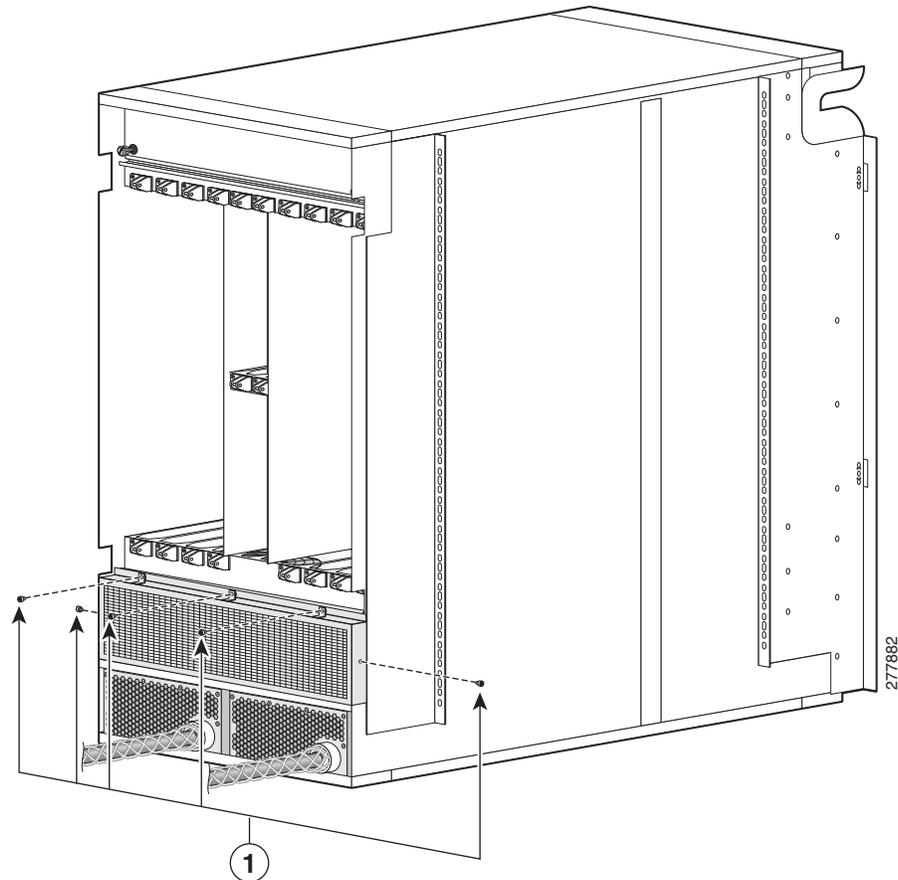
1	Rear Exhaust Screen

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Attach the screen to the rear of the chassis using the five panel fasteners

Removing a Lower Fan Tray

This section describes how to remove a fan tray from the lower fan tray slot of the Cisco CRS 8-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System.*

A Cisco CRS 8-slot line card chassis fan tray operates in either the upper or lower fan tray slot. Each fan tray is installed into the rear (MSC) side of the chassis (see Figure 3-4).

Figure 3-4   Fan Tray

1	Captive screws	3	Fan tray handle
2	Fan tray rail		

Prerequisites

Before performing this task, you must first remove any front cover plates.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large flat-blade screwdriver

Steps

To remove a lower fan tray, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the screwdriver, loosen the two captive screws on the fan tray.

⚠

Caution A fan tray weighs approximately 19.15 pounds (8.69 kg). Use both hands when handling a fan tray.

Step 3 Rotate the fan tray handle out.

Step 4 Grasp the fan tray handle and pull it straight out to disconnect the fan tray from the connector mounted on the back of the fan tray. Slide the fan tray halfway from the fan tray bay.

Step 5 Use your free hand to support the fan tray, then slide the fan tray completely from the fan tray bay.

Step 6 Set the fan tray safely aside.

⚠

Caution Do not set the fan tray down on the connector; doing so could damage it.

What to Do Next

After performing this task, replace the front cover plates.

Installing an Upper Fan Tray

This section describes how to install a fan tray in the upper fan tray slot of the Cisco CRS 8-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

A Cisco CRS 8-slot line card chassis fan tray operates in either the upper or lower fan tray slot. Each fan tray installs into the rear (MSC) side of the chassis (see Figure 3-4).

Prerequisites

Before performing this task, you must first open the chassis doors and remove any front cosmetic covers.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Fan tray (Cisco product number CRS-8-LCC-FAN-TR=)

Steps

To install an upper fan tray, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2 Using the screwdriver, unscrew the two captive screws holding the fan tray bay door in place.

Step 3 Lift the door up; you may need a second person to hold it in the open position.

Step 4 Rotate the handle on the fan tray to the open position.

Step 5 Using two hands to support the fan tray, position it in front of the fan tray bay so that the rails on the sides of the fan tray are aligned with the rail guides on the interior of the chassis.

⚠

Caution   A fan tray weighs approximately 19.15 pounds (8.69 kg). Use both hands when handling a fan tray.

Step 6   Slide the fan tray into the bay.

Step 7   Slide the fan tray into the fan tray bay. Stop when the fan tray meets the chassis connector in the back of the fan tray bay.

Notice that the tray (and rail guides) drop just inside the fan tray bay door, so that the fan tray "drops" into its final position as it gets almost all the way into the chassis.

⚠

Caution   To prevent damage to the chassis connector, do not use excessive force when inserting a fan tray into its bay.

Step 8   Firmly push on the fan tray to seat the fan tray connector in the chassis connector.

✎

Note   All electrical and control line connections are made automatically when the connectors mate.

Step 9   Rotate the fan tray handle to the closed (flush) position.

Step 10   Replace the fan tray bay door and tighten the two captive screws on the fan tray bay door.

What to Do Next

After performing this task, replace the front cover plates.

Removing an Upper Fan Tray

This section describes how to remove a fan tray from the upper fan tray slot of the Cisco CRS 8-slot line card chassis. For information on the chassis airflow and circulation, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

A Cisco CRS 8-slot line card chassis fan tray operates in either the upper or lower fan tray slot. Each fan tray is installed into the rear (MSC) side of the chassis (see Figure 3-4).

Prerequisites

Before performing this task, you must first open the chassis doors and remove any front cosmetic covers.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove an upper fan tray, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the rear (MSC) side of the chassis or a bare metal surface on the chassis.

Step 2   Using the screwdriver, unscrew the two captive screws holding the fan tray bay door in place.

Step 3   Lift the door up; you may need a second person to hold it in the open position.

Step 4   Rotate the handle on the fan tray to the open position.

Step 5   Pull firmly and steadily on the fan tray handle to unseat it from the chassis connector, and then slide it partway from the fan tray bay.

⚠️

Caution   Do not pull too hard on the fan tray; too strong a pull can cause the tray to slide out too quickly, causing your hand to scrape against the fan tray door.

Step 6   Place your hand under the fan tray to support it from beneath.

⚠️

Caution   A fan tray weighs approximately 19.15 pounds (8.69 kg). Use both hands when handling a fan tray.

Step 7   Slide the fan tray from the bay and set it carefully aside.

Step 8   Replace the fan tray bay door and tighten the two captive screws on the fan tray cover bay door.

What to Do Next

After performing this task, replace the front cover plates.

Installing the Chassis Air Filter

This section describes how to install the air filter in the Cisco CRS 8-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

The chassis has a serviceable air filter mounted in a slide-out tray, accessible from the rear of the chassis just above the lower fan tray. The Cisco CRS 8-slot line card chassis air filter plugs into the front (PLIM) side of the chassis (see Figure 3-5).

Figure 3-5   Chassis Air Filter
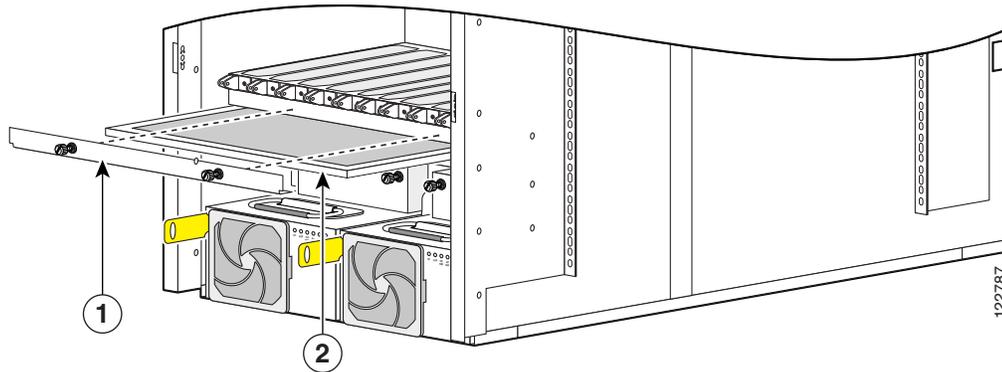
| 1 | Air filter cover plate (with captive screws) | 2 | Chassis air filter |

Prerequisites

Before performing this task, you must first remove any front cover plates.

⚠

Caution   Never operate the Cisco CRS 8-slot line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Chassis air filter (Cisco product number CRS-8-LCC-FILTER=)

Steps

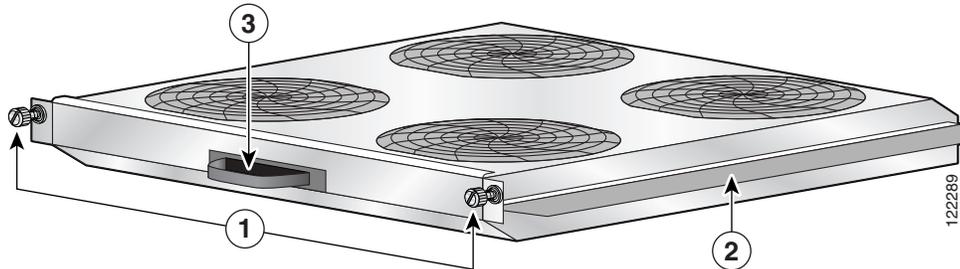To install the chassis air filter, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Using two hands to support the air filter, orient it so that the ridge on the front of the air filter faces outward from the front of the chassis and the wire-grid backing support is facing up.

Step 3   Slide the air filter into the air filter slot until it is seated fully within the slot.

Step 4   Hold the air filter cover plate in place and tighten the two captive screws on the front of the plate.

What to Do Next

After performing this task, replace the front cover plates.

Removing the Chassis Air Filter

This section describes how to remove the air filter in the Cisco CRS 8-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

The Cisco CRS 8-slot line card chassis air filter plugs into the front (PLIM) side of the chassis (see Figure 3-5).

Prerequisites

Before performing this task, you must first remove any front cover plates.

⚠️
Caution   Never operate the Cisco CRS 8-slot line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove the chassis air filter, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Using the screwdriver, loosen the two captive screws on the air filter cover faceplate.

Step 3   Remove the cover faceplate and set it carefully aside.

Step 4   Grasp the air filter and carefully slide it from the slot.

Step 5   Set the air filter carefully aside.

What to Do Next

After performing this task, replace the front cover plates.

Chapter 3   Installing and Removing Air Circulation Components

How to Install or Remove Air Circulation Components

Installing a Power Module Air Filter

This section describes how to install a power module air filter for the Cisco CRS 8-slot line card chassis. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

Each power module has a serviceable air filter that is attached to the front of the power module and is held in place by an air filter clip-on holder. The power module air filter faces outward from the front of the chassis (see Figure 3-6).

Figure 3-6   Power Module Air Filter
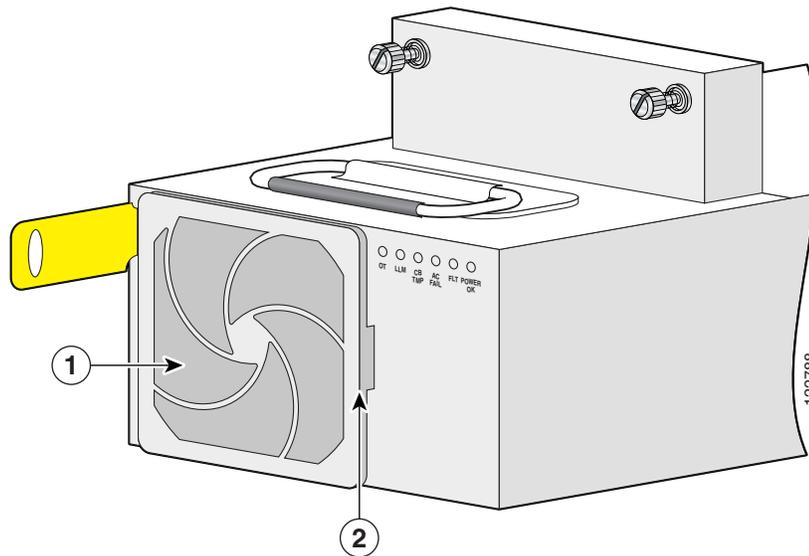
| 1 | Power module air filter | 2 | Air filter clip-on holder |

Prerequisites

Before performing this task, you must first remove any front cover plates.

⚠

Caution   Never operate the Cisco CRS 8-slot line card chassis without an air filter. Doing so can damage the hardware.

Required Tools and Equipment

You need the following tools and part to perform this task:

• ESD-preventive wrist strap

• Medium flat-blade screwdriver

• Air filter (Cisco product number CRS-8-PWR-FILTER=)

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Steps

To install a power module air filter, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Place the screwdriver under the edge of the air filter clip-on holder.

Step 3   Gently pry the holder loose with the screwdriver; it should pop off easily.

Step 4   Place the air filter in position on the front of the power module.

Step 5   Place the holder in position on the front of the power module over the air filter.

Step 6   Press the holder firmly but gently until it snaps into place.

What to Do Next

After performing this task, replace the front cover plates.

Removing a Power Module Air Filter

This section describes how to remove a power module air filter. For further information, see the "About Line Card Chassis Airflow" section on page 3-1. For complete information on regulatory compliance and safety, see *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*.

Each power module has a serviceable air filter that is attached to the front of the power module and is held in place by an air filter clip-on holder. The power module air filter faces outward from the front of the chassis (see Figure 3-6).

Prerequisites

Before performing this task, you must first remove any front cover plates.

⚠

Caution   Never operate the Cisco CRS 8-slot line card chassis without an air filter. Doing so can result in damage to the hardware.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver

Steps

To remove a power module air filter, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Place the screwdriver under the edge of the air filter clip-on holder.

Step 3   Gently pry the holder loose with the screwdriver; it should pop off easily.

Step 4   Remove the air filter from the front of the power module and set it carefully aside.

What to Do Next

After performing this task, you may install a new air filter (see the "Installing a Power Module Air Filter" section on page 3-12) and replace the front cover plates.

CHAPTER 4

Installing and Removing Line Cards, PLIMs, and Associated Components

This chapter provides instructions on how to install and remove the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis modular services cards (MSCs), physical layer interface modules (PLIMs), and any associated components. This chapter presents the following topics:

Information About Installing and Removing Cards and Associated Components

This section contains some general information about installing and removing cards, PLIMs, and associated components.

Guidelines and Warnings for Card Installation and Removal

This section contains the guidelines for card installation and removal.

⚠
Caution   Removing more than one card at a time can misalign the chassis and may damage the card or chassis when reinserting the cards. Remove and reinsert only one card at a time.

Online (in-service) insertion and removal (OIR) is supported, enabling you to remove and install cards while the router is operating. OIR is seamless to users on the network, maintains all routing information, and ensures session preservation. Notifying the software or resetting the power is not required. However, you have the option of using the **shutdown** command before removing a card.

The different cards and PLIMs in the line card chassis are all attached to the chassis itself using a pair of ejector levers and captive screws. The two ejector levers release the card or PLIM from its midplane connector. The exact location of the ejector levers and captive screws varies slightly from card to card, but are in general in the same location: on the upper and bottom of the faceplate of the card. Figure 4-1 shows the location of the ejector levers and captive screws on an MSC.

Figure 4-1   Ejector Levers and Captive Screws
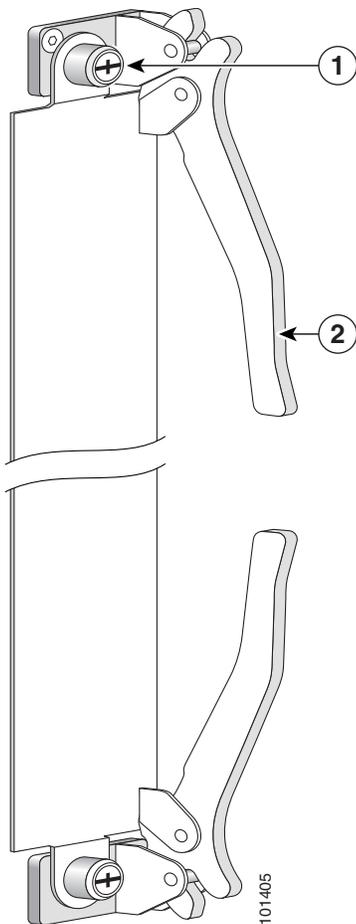
| **1** | Captive screw | **2** | Ejector lever |

Figure 4-2 shows how to operate the ejector levers. Be sure to operate both levers simultaneously.

Figure 4-2   ***Operating Ejector Levers***
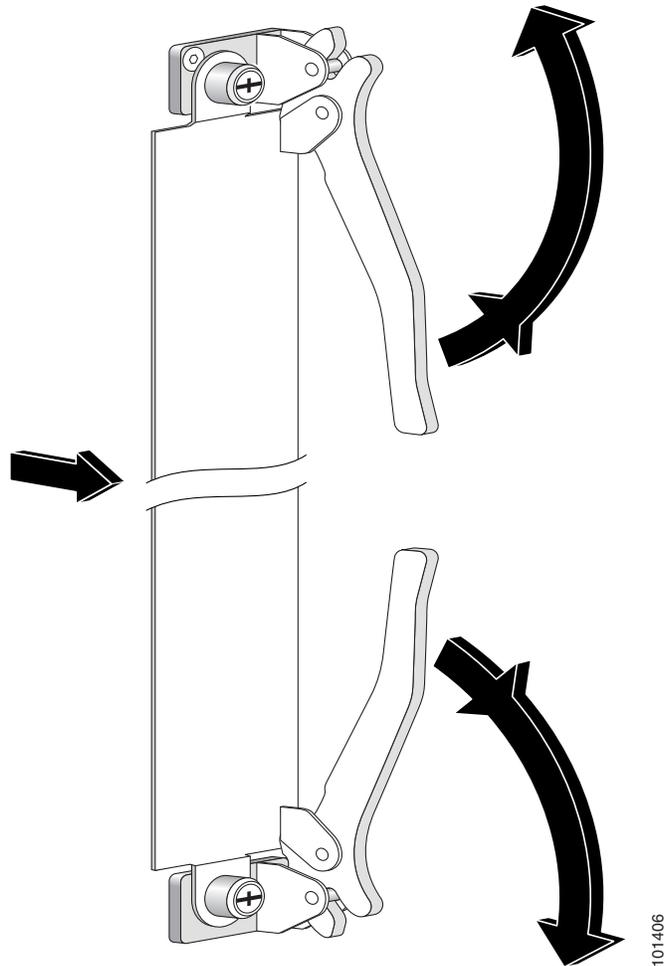
When shipped, every slot in the chassis contains either an impedance carrier, or is covered by a slot cover (see the "Information About Impedance Carriers and Slot Covers" section on page 4-6).

Note   While it is not critical for you to install the cards in a certain order, following the card installation recommendations in this chapter will make your installation process easier.

Chassis Slot Numbers

Figure 4-3 and Figure 4-4 show the slot numbers for the Cisco CRS 8-slot line card chassis.

Figure 4-3   Line Card Chassis Slot Numbers—Front (PLIM) Side

Figure 4-4   Line Card Chassis Slot Numbers—Rear (MSC) Side

Recommended Order of Card Installation

Card should be installed in a particular order. We recommend the following order when removing the impedance carriers and installing the cards in the chassis (see Figure 4-3 and Figure 4-4):

1. Install the RP cards first one card at a time, the left one (slot RP0) before the right one (slot RP1). Tighten the screws only after fully inserting both RP cards.

    Note   It is important to engage and partially tighten all screws first, before fully tightening them with a screwdriver. This action helps ensure that all parts are aligned properly in the chassis.

2. Install the switch fabric cards one at a time in the same manner.

    We recommend that you install fabric cards from left to right, starting from top to bottom, in this order:

    – Slot SM0

    – Slot SM1

    – Slot SM2

    – Slot SM3

3. For the line cards and PLIMs, you must remove one impedance carrier, install a functional board, and tighten the screw; then repeat the process until all cards and PLIMs have been installed.

Cautions and Recommendations

Caution   When you remove a card, always use the ejector levers to ensure that the connector pins disconnect from the midplane in the sequence expected by the router.

Caution   The router may indicate a hardware failure if you do not follow proper procedures. **Remove or install only one card at a time**. Allow at least 15 seconds for the router to complete the preceding tasks before removing or installing another card.

Do not operate the Cisco CRS 8-slot line card chassis with any slots completely empty; doing so could lead to an airflow bypass condition that diverts airflow from slots containing heat-generating electronics, possibly causing thermal alarms to occur at lower-than-expected ambient temperatures.

To avoid airflow bypass, all slots should be filled with their appropriate cards or impedance carriers. If you have to replace a card, we recommend leaving the card in place in the chassis until you are ready to install the new one.

Tip   To lessen the possibility of damaging the connectors on the chassis midplane, you should visually inspect the connector pins on the cards before you insert them into the chassis.

Information About Impedance Carriers and Slot Covers

When shipped, all slots in the chassis either contain impedance carriers or are covered by slot covers to help maintain chassis stiffness and ensure that the chassis is undamaged during shipment. Four different types of impedance carriers and slot covers exist for the four different sizes of slots in the chassis (see Figure 4-5, Figure 4-6 on page 4-7, Figure 4-7 on page 4-8, and Figure 4-8 on page 4-9).

Figure 4-5   Switch Fabric Slot (Half Height) Slot Cover
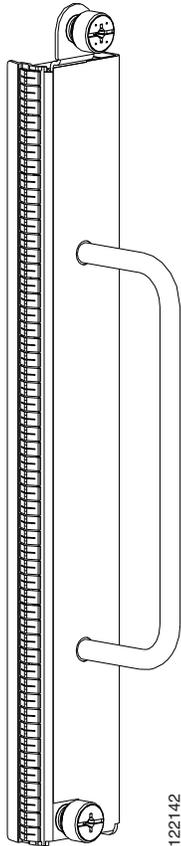
Figure 4-6   RP Slot Impedance Carrier
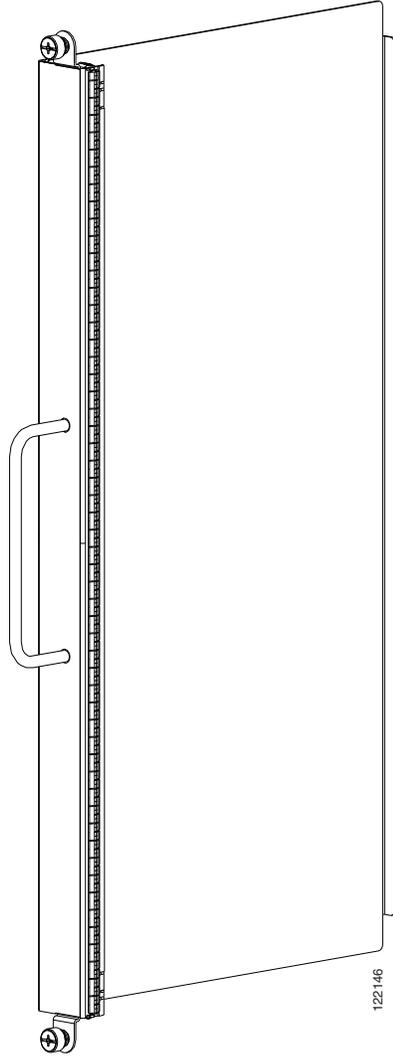
Figure 4-7   PLIM Slot Impedance Carrier
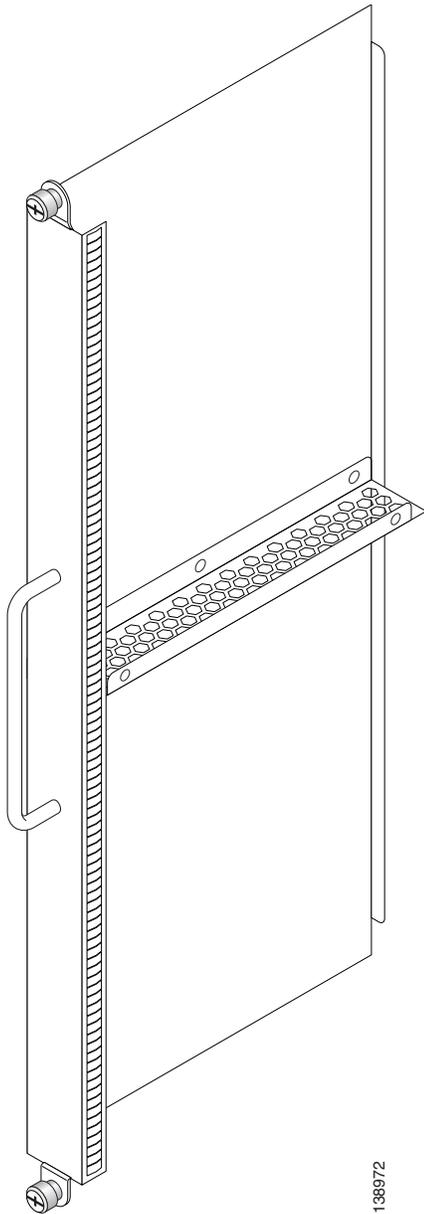
Figure 4-8   *MSC Slot Impedance Carrier*
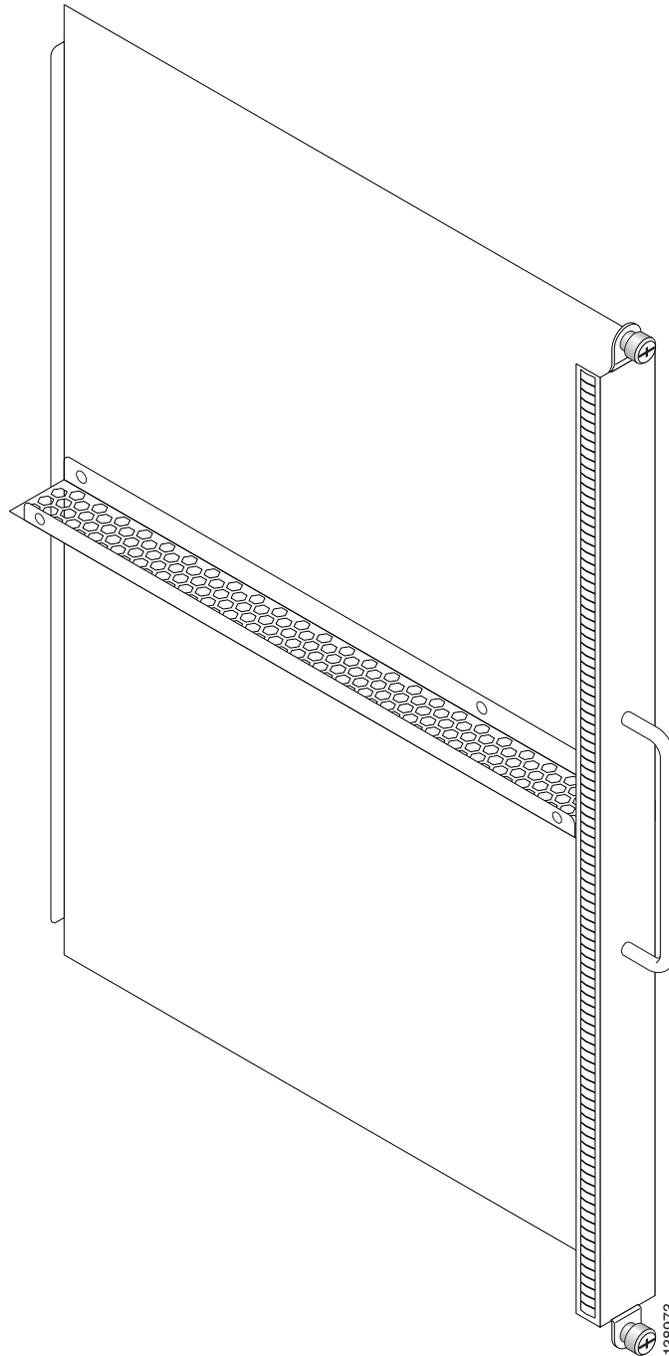
For further information on installing and removing the slot covers and impedance carriers, see the "Installing a Slot Cover" section on page 4-13, the "Removing a Slot Cover" section on page 4-15, the "Installing an Impedance Carrier" section on page 4-16, and the "Removing an Impedance Carrier" section on page 4-18.

Information About Distributed Route Processors and Distributed Route Processor PLIMs

The Cisco CRS Carrier Routing System provides distributed route processor (DRP) support through the installation of DRP PLIMs and DRP cards on the Cisco CRS 8-slot line card chassis (see Figure 4-9 and Figure 4-10). The installation of DRPs provides you with the ability to configure the system for logical router support and additional processor power for multichassis systems.

Figure 4-9   *DRP PLIM*

138153
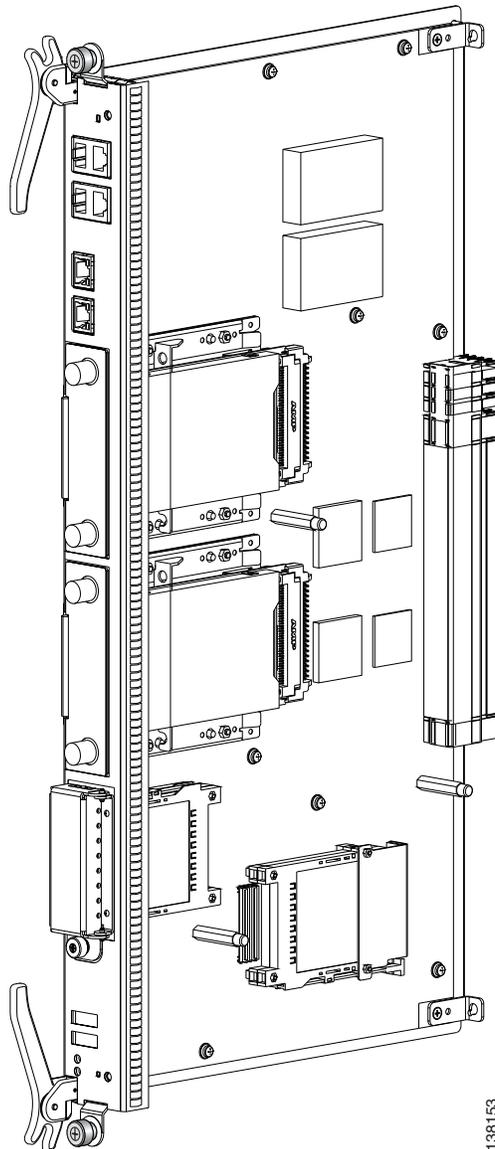
Figure 4-10   DRP Card
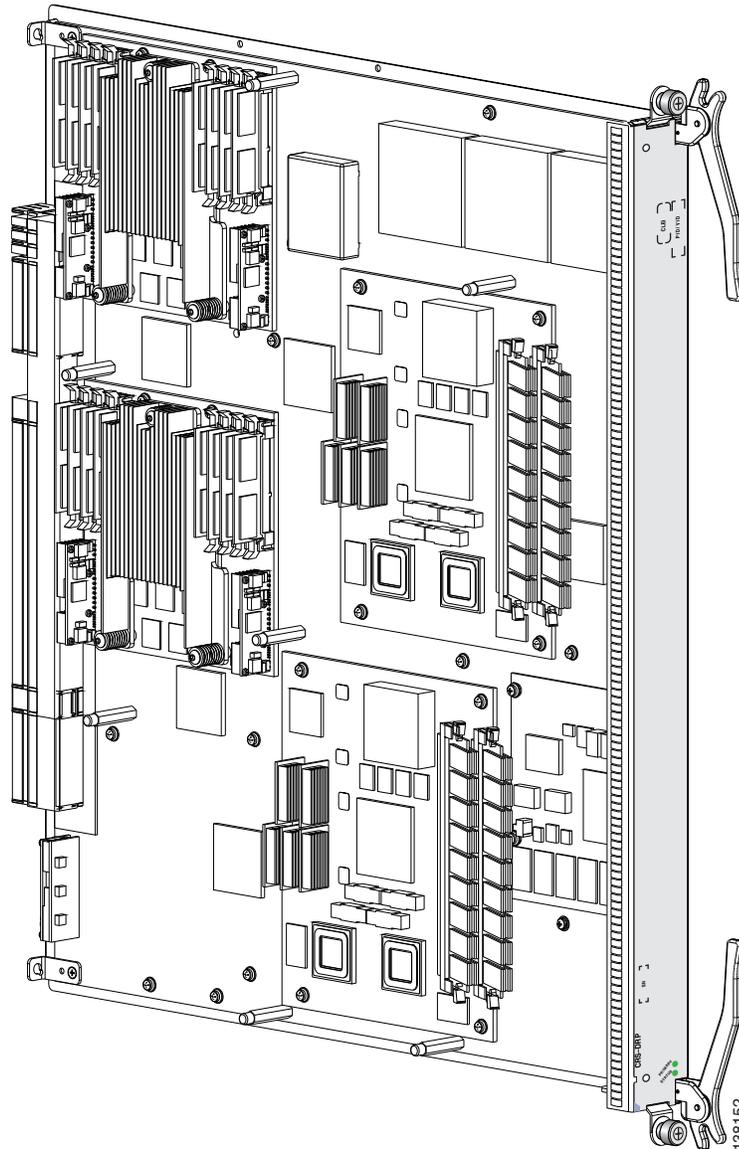
For DRP support, you must install both the DRP PLIM in a PLIM slot on the front (PLIM) side of the chassis and a DRP card in the corresponding slot on the rear (MSC) side of the chassis. The DRP PLIM and DRP cards are installed in the same manner as regular PLIMs and MSCs. See the "How to Install or Remove a Physical Layer Interface Module" section on page 4-47 or the "How to Install or Remove an MSC, FP, or LSP" section on page 4-29 for further information.

DRPs contain two CPU complexes, independent of each other, each with its own hard drive. In addition, the DRP provides you with two PCMCIA card slots, similar to the RP. For further information, see the "Information About Hard Drives and PCMCIA Cards" section on page 4-12. For installation or removal information, see the "Removing an RP PCMCIA Card" section on page 4-46.

Information About Small Form-Factor Pluggable (SFP) Modules

The SFP module for the line card chassis uses the bale clasp latch type.

⚠️
Caution   Protect the SFP modules by inserting clean dust covers into them after the cables are removed from them. Be sure to clean the optic surfaces of the fiber cables before you plug them back into the optical ports of another SFP module. Avoid getting dust and other contaminants into the optical ports of the SFP modules: The optics do not work correctly when obstructed with dust.

✎
Note   Only the 16-port OC-48c/STM-16c MSC uses SFP modules.

Information About Hard Drives and PCMCIA Cards

Optional and replaceable hard drives and PCMCIA cards are available for the DRP cards.

The hard drive is an IDE hard drive used for gathering debugging information, such as core dumps from the DRPs or MSCs. The IDE hard drive is typically powered down and activated only when there is a need to store data. The drive is not vital to a functioning chassis and is optional.

✎
Note   Core dumps are discoverable only through intervention with the chassis system software.

Physically, the DRP hard drive is a hot-pluggable PC board and sled-mounted drive with a connector interface that gets cleanly seated into a route processor card. In general, removal and replacement of this drive is not required.

The DRP cards provide two PCMCIA flash slots, each card providing up to 1 GB of flash storage. One of the PCMCIA flash subsystems is accessible externally, is removable, and allows you to transfer images and configurations by plugging in a PCMCIA flash card. The other subsystem is fixed to the DRP, not removable, and for permanent storage of configurations and images.

Information About Cable Management Brackets

The Cisco CRS 8-slot line card chassis includes a cable management system that organizes the interface cables entering and exiting the different cards, keeping them out of the way and free of sharp bends.

⚠️
Caution   Excessive bending of interface cables can damage the cables.

The Cisco CRS 8-slot line card chassis arrives preinstalled with a horizontal cable management bracket on the front of the chassis and an optional horizontal cable management bracket orderable for the rear of the chassis.

Figure 4-11 shows the chassis cable management bracket.

Figure 4-11   Cable Management Bracket

How to Install or Remove a Slot Cover

This section contains the following procedures:

- Installing a Slot Cover, page 4-13
- Removing a Slot Cover, page 4-15

Installing a Slot Cover

This section describes how to install a slot cover in the Cisco CRS 8-slot line card chassis. The chassis is shipped with slot covers over the switch fabric card and RP card slots; we advise installing slot covers over any empty slots in the chassis. Both slot cover types are installed in the same manner. (Figure 4-12 shows a switch fabric slot cover for reference.) For more detailed information on the slot covers, see the "Information About Impedance Carriers and Slot Covers" section on page 4-6.

Figure 4-12   Switch Fabric Slot (Half Height) Slot Cover
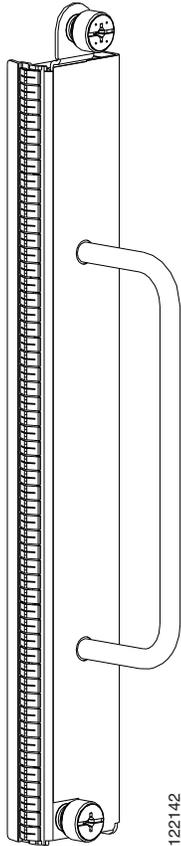
Prerequisites

Before performing this task, remove any cosmetic covers and ensure that the slot over which you are about to install the cover is empty. See the "Removing an RP, PRP, or DRP Card" section on page 4-41 and the "Removing a Switch Fabric Card" section on page 4-26.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Slot cover

Steps

To install a slot cover, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2   Using the handle, hold the slot cover in place over the slot.

Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide

Step 3   Partially tighten the four captive screws on the front panel of the slot cover (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 4   To seat the slot cover firmly in place, fully tighten the captive screws.

What to Do Next

After performing this task, replace any rear (MSC) side cosmetic covers.

Removing a Slot Cover

This section describes how to remove a slot cover from the Cisco CRS 8-slot line card chassis. The chassis is shipped with slot covers over the switch fabric card and RP card slots. Both slot cover types are removed in the same manner. (Figure 4-13 shows a switch fabric slot cover for reference.) For more detailed information on the slot covers, see the "Information About Impedance Carriers and Slot Covers" section on page 4-6.

Figure 4-13   Switch Fabric Slot (Half Height) Slot Cover
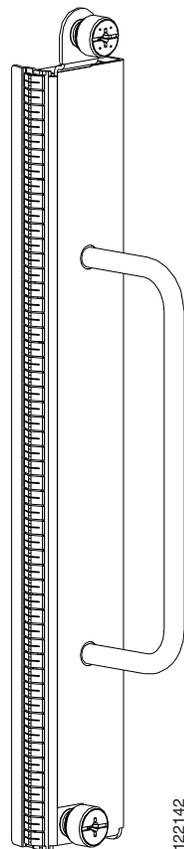
Prerequisites

Before performing this task, remove any rear (MSC) side cosmetic covers.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove a slot cover, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2   Grasp the slot cover with one hand.

Step 3   Loosen the captive screws that attach the slot cover to the chassis.

Step 4   Holding the slot cover by the handle, remove it and set it carefully aside.

What to Do Next

After performing this task, store the slot cover for later reuse. You may now install a card in the uncovered slot. See the "Installing a Switch Fabric Card" section on page 4-22 and the "Installing an RP, PRP, or DRP Card" section on page 4-38 for further details.

How to Install or Remove an Impedance Carrier

This section contains the following procedures:

- Installing an Impedance Carrier, page 4-16
- Removing an Impedance Carrier, page 4-18

Installing an Impedance Carrier

This section describes how to install an impedance carrier into the Cisco CRS 8-slot line card chassis. The chassis is shipped with impedance carriers installed in the MSC and PLIM slots. Both impedance carrier types are installed in the same manner. (Figure 4-14 shows an MSC impedance carrier for reference.) For more detailed information on impedance carriers, see the "Information About Impedance Carriers and Slot Covers" section on page 4-6.

Figure 4-14   MSC Slot Impedance Carrier
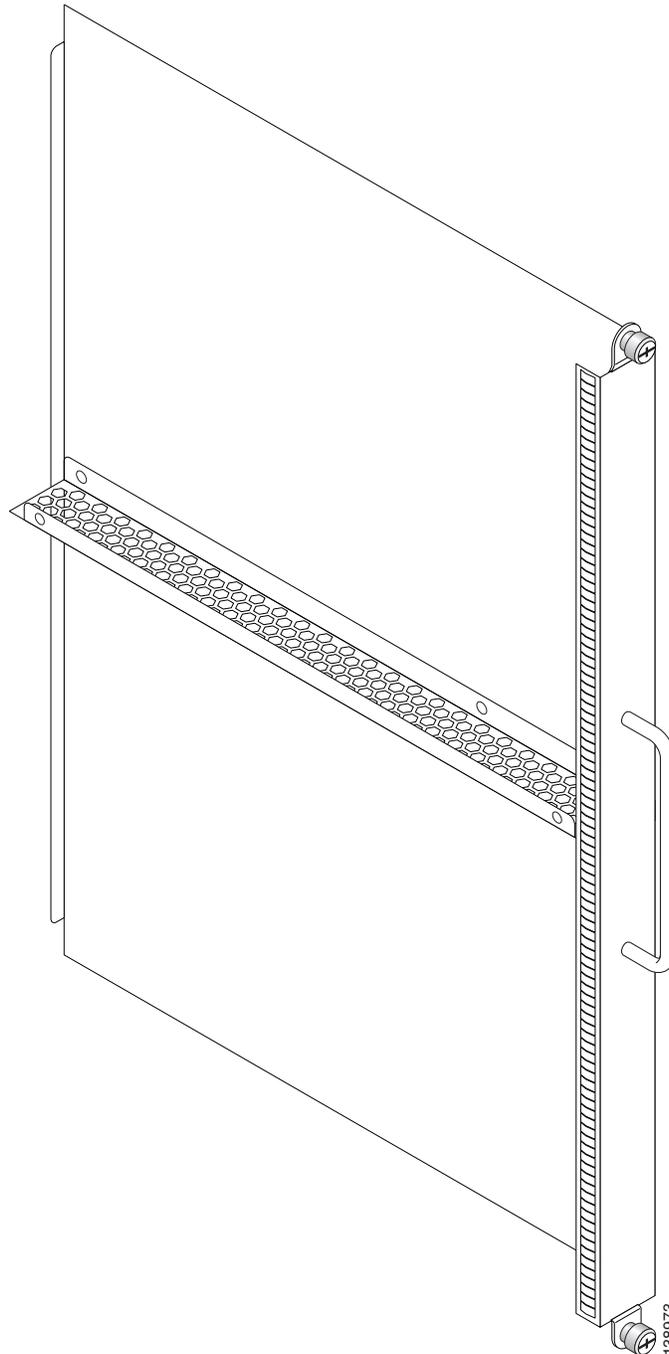
Prerequisites

Before performing this task, remove any cosmetic covers and ensure that the slot in which you are about to install the impedance carrier is empty. Depending on the slot in which you are installing an impedance carrier, see the "Information About Impedance Carriers and Slot Covers" section on page 4-6 and the "Removing an MSC, FP, or LSP" section on page 4-33 or the "Removing a PLIM" section on page 4-51.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Impedance carrier (MSC impedance carrier Cisco Product number CRS-MSC-IMPEDANCE=; PLIM impedance carrier Cisco Product number CRS-INT-IMPEDANCE=)

Steps

To install an impedance carrier, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2 Use both hands while inserting an impedance carrier. Use one hand on the faceplate and the other hand along the base of the impedance carrier to guide it into a slot.

Step 3 Slide the impedance carrier into the chassis until the captive screw plates are flush with the chassis.

Step 4 Partially tighten the two captive screws on the front panel of the impedance carrier (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 5 To seat the impedance carrier firmly in the slot, fully tighten the captive screws.

What to Do Next

After performing this task, replace any cosmetic covers.

Removing an Impedance Carrier

This section describes how to remove an impedance carrier from the Cisco CRS 8-slot line card chassis. Both impedance carrier types are removed in the same manner. (For reference, Figure 4-14 shows an MSC impedance carrier.) For more detailed information on impedance carriers, see the "Information About Impedance Carriers and Slot Covers" section on page 4-6.

Prerequisites

Before performing this task, remove any cosmetic covers.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove an impedance carrier, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2 Identify the impedance carrier to be removed from the card cage.

Step 3 To loosen the impedance carrier from the slot, turn the two captive screws on the front panel of the card counterclockwise.

Step 4 Grasp the impedance carrier handle with one hand and gently pull it halfway from the slot.

Step 5 Place one hand under the impedance carrier to guide it.

Step 6 Holding the impedance carrier underneath and by the handle, pull it from the slot and set it carefully aside.

What to Do Next

After performing this task, store the impedance carrier for future use. You may now install a card in the uncovered slot. See the "Installing an MSC, FP, or LSP" section on page 4-29 and the "Installing a PLIM" section on page 4-47 for further details.

How to Install or Remove a Pillow Block

This section contains the following procedures:

- Installing a Pillow Block, page 4-19
- Removing a Pillow Block, page 4-21

Installing a Pillow Block

This section describes how to install a replacement pillow block on the chassis after removing a damaged pillow block. A pillow block is a bracket with a pin that is attached to the chassis above and below each card slot. When you install or remove a card from the chassis, the card ejector levers hook into the pillow blocks above and below the card slot to secure the cards to the slot and allow you to install and remove the cards.

Prerequisites

Before performing this task, you must first open the front cosmetic doors (if installed). Have the pillow block replacement kit (Cisco product number: CRS-PILLBLK=) at hand.

Required Tools and Equipment

.You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Pillow block replacement kit (Cisco product number: CRS-PILLBLK=)

The following items are included in the CRS-PILLBLK= pillow block replacement kit:

- 2 replacement pillow blocks
- 6 Torx-head screws
- 1 T10 Torx screwdriver (See item 1 in Figure 4-15.)

Steps

To install a pillow block, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Locate the slot where the pillow block was removed.

Step 3   Have the replacement T10 Torx-head screws near at hand.

Step 4   Position the pillow block and align the screw holes.

Step 5   Use the T10 Torx screwdriver to install the top left screw (located above the pillow block pin). (See item number 2 in Figure 4-15.)

Figure 4-15   *Installing a Pillow Block*
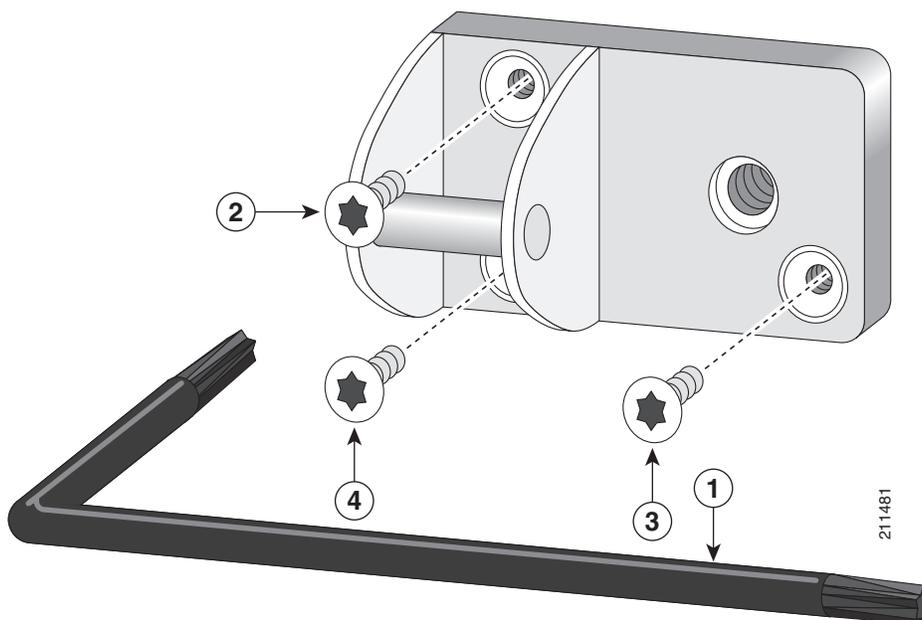
Step 6   Install the lower right screw (see item number 3 in Figure 4-15).

Step 7   Install the lower left screw (located below the pillow block pin). (See item number 4 in Figure 4-15.)

Step 8   Repeat this procedure for the card slot's other pillow block if necessary.

What to Do Next

After performing this task, replace any cosmetic covers.

Removing a Pillow Block

This section describes how to remove a damaged pillow block from the chassis. A pillow block is a bracket with a pin that is attached to the chassis above and below each card slot. When you install or remove a card from the chassis, the card ejector levers hook into the pillow blocks above and below the card slot to secure the cards to the slot and allow you to install and remove the cards.

Prerequisites

Before performing this task, you must first open the front cosmetic doors (if installed). Have the pillow block replacement kit (Cisco product number: CRS-PILLBLK=) at hand.

Required Tools and Equipment

.You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Pillow block replacement kit (Cisco product number: CRS-PILLBLK=)

The following items are included in the CRS-PILLBLK= pillow block replacement kit:

- 2 replacement pillow blocks
- 6 Torx-head screws
- 1 T10 Torx screwdriver (See item 1 in Figure 4-16.)

Steps

To remove a damaged pillow block, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   Locate the pillow block to be replaced. Use the T10 Torx screwdriver to remove the lower right screw. (See item number 2 in Figure 4-16.)

Figure 4-16   *Removing a Pillow Block*
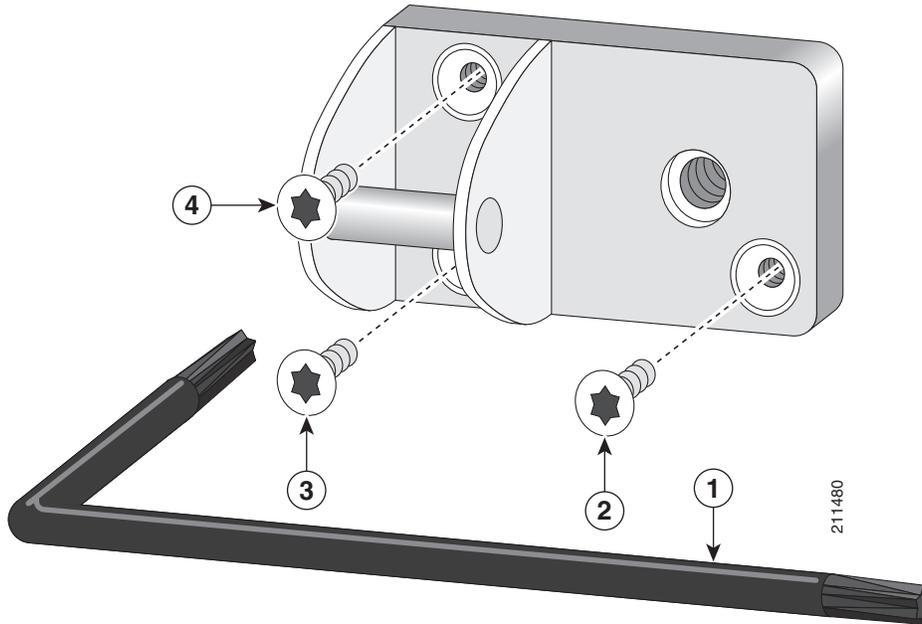
Step 3   Remove the lower left screw (located below the pillow block pin). (See item number 3 in Figure 4-16.)

Step 4   Remove the top left screw (located above the pillow block pin). (See item number 4 in Figure 4-16.)

Step 5   Remove the pillow block and set it aside.

Step 6   Repeat this procedure for the card slot's other pillow block if necessary.

What's Next

After performing this task, you may install a new pillow block (see the "Installing a Pillow Block" section on page 4-19).

How to Install or Remove a Switch Fabric Card

This section contains the following procedures:

Installing a Switch Fabric Card

This section describes how to install a switch fabric card in the Cisco CRS 8-slot line card chassis. For more detailed information on the switch fabric card, see *Cisco CRS Series Carrier Routing System 8-Slot Line Card Chassis System Description*.

The switch fabric card is used only in single-chassis systems. The switch fabric card does not contain any fiber-optic connectors because it is not connected to any other switch fabric modules (see Figure 4-17).

Figure 4-17   Switch Fabric Card
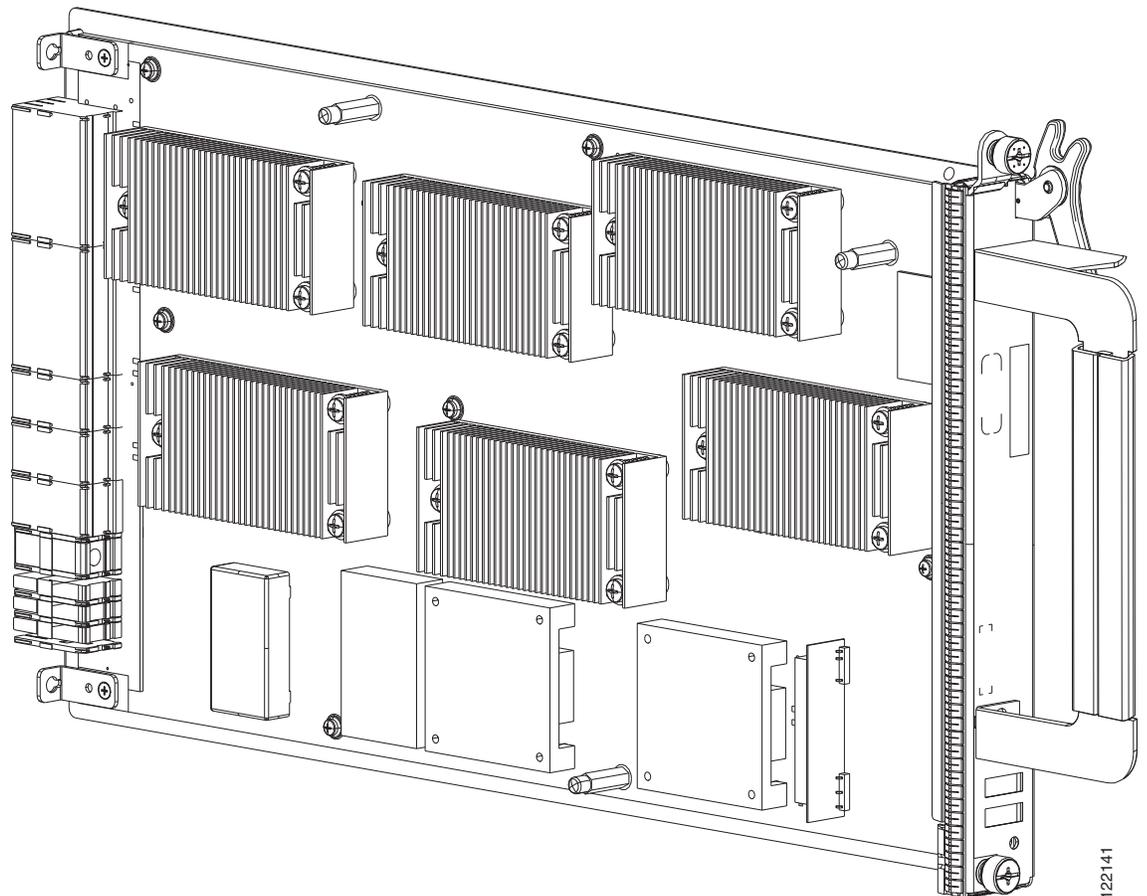
Prerequisites

Before performing this task, remove any front cover plates from the chassis, and remove any switch fabric card or switch fabric impedance cover from the slot in which you plan on installing the switch fabric card. See the "Information About Impedance Carriers and Slot Covers" section on page 4-6 and the "Removing a Switch Fabric Card" section on page 4-26.

⚠️

Caution   Removing more than one switch fabric card at a time can misalign the chassis and may damage the card or chassis when reinserting the cards. Remove and reinsert only one card at a time.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Switch fabric card

Steps

To install a switch fabric card, see Figure 4-18 and follow these steps:

Figure 4-18   ***Installing a Switch Fabric Card***
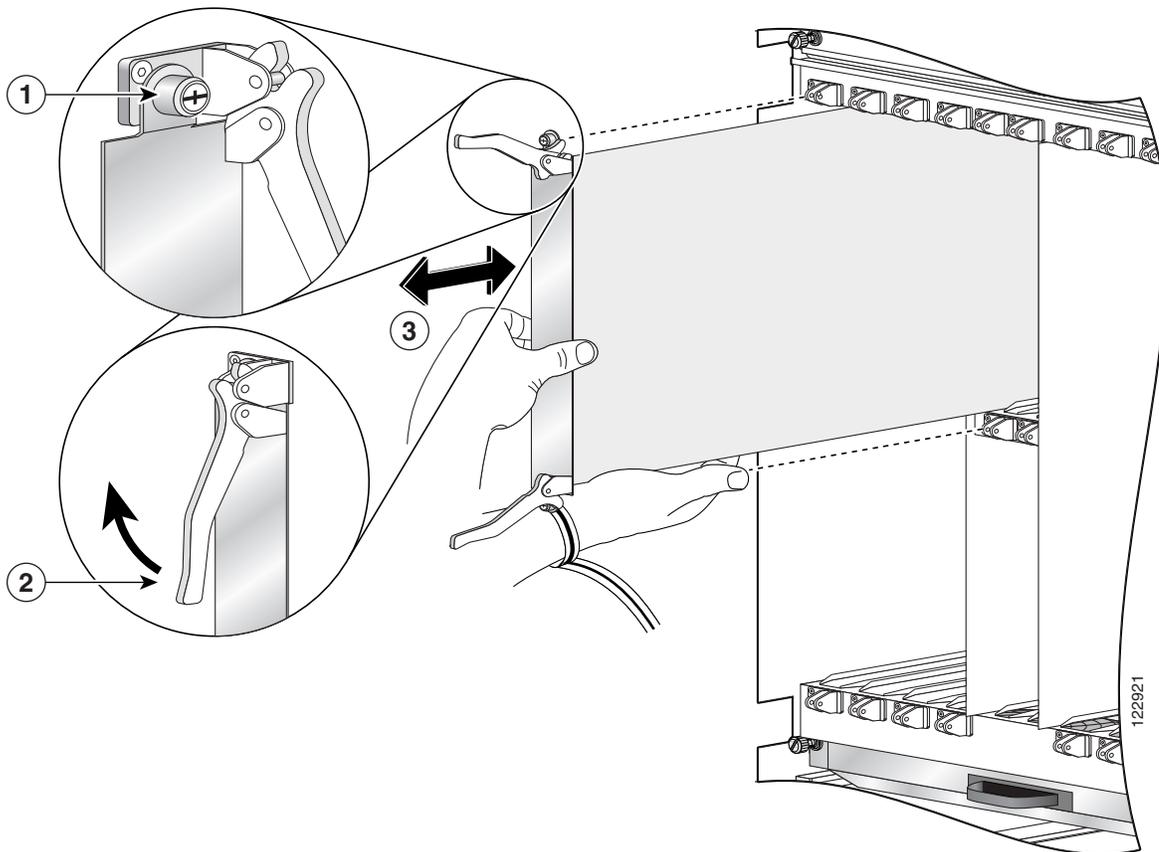
1	Captive screw	3	Direction of installation or removal
2	Ejector lever		

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2   Remove the switch fabric card from its antistatic packaging.

Step 3   Visually inspect the connector pins on the card before you insert it into the chassis. Do not attempt to install a card with bent pins, as this may damage the chassis midplane connectors.

Step 4   Grasp the card carrier handle with one hand and place your other hand under the carrier to support and guide it into the correct slot.

Step 5   Position the card for insertion into the card cage slot. Avoid touching the card circuitry or any connectors.

> **Note**   Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 6   Orient the switch fabric card so that the PCB faces left and the carrier is to the right; if the card does not slide easily into the slot, the orientation may be wrong and the misorientation rejection flange is stopping the card from going in. Reorient the switch fabric card, if necessary.

Step 7   Carefully slide the switch fabric card into the slot until the ejector levers meet the edges of the card cage, then *stop* when the ejector lever hooks catch the lip of the card cage. If they do not catch, try reinserting the switch fabric card until the ejector lever hooks are fully latched.

> **Note**   The insertion of the switch fabric card into the chassis may require more force than is typical of the other cards in the chassis.

Step 8   Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

> **Caution**   Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the levers, thereby damaging or breaking one or both of them.

Step 9   Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

> **Note**   Switch fabric cards have guide pins that make initial contact with the midplane connector as you slide a card into its slot. After the guide pins make contact, continue pushing the card carrier until the card ejector levers begin pivoting forward, toward the handle in the card carrier.

Step 10   To seat the card in the midplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

> **Tip**   The flange on the front panel of the card carrier should be flush against the card cage.

Step 11   Partially tighten the two captive screws on the front panel of the card (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 12   Use the screwdriver to fully tighten the captive screws to seat the card firmly in the slot.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.

- Replace any front cover cosmetic plates and verify that the card has been installed properly (see the "Verifying the Installation of a Switch Fabric Card" section on page 4-28).

- If you are performing the initial installation of the system, install the MSCs (see the "Installing an MSC, FP, or LSP" section on page 4-29).

Removing a Switch Fabric Card

This section describes how to remove a switch fabric card from the Cisco CRS 8-slot line card chassis. For more detailed information on the switch fabric card, see *Cisco CRS Series Carrier Routing System 8-Slot Line Card Chassis System Description*.

The switch fabric card is used only in single-chassis systems. The switch fabric card does not contain any fiber-optic connectors because it is not connected to any other switch fabric modules (see Figure 4-19).

Figure 4-19   Switch Fabric Card
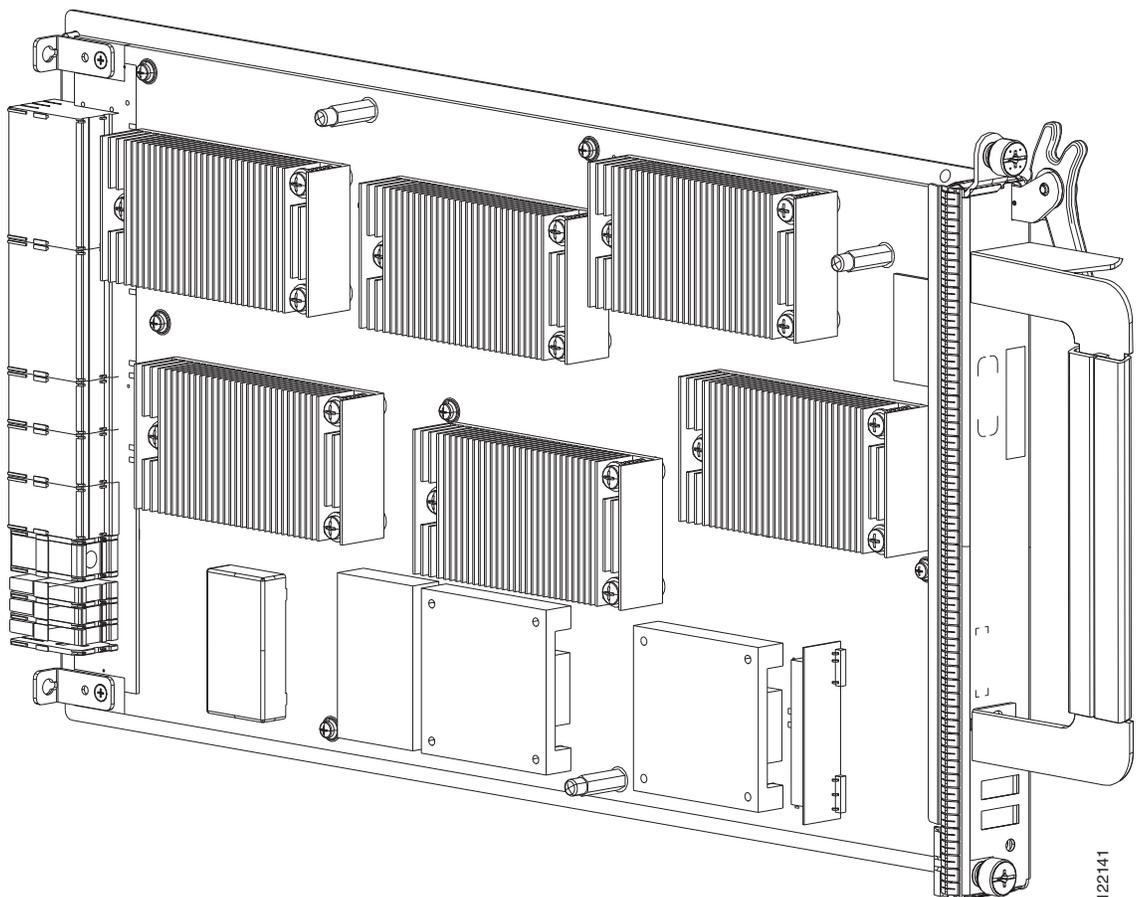
Prerequisites

Before performing this task, remove any front cover plates.

⚠️

Caution   Removing more than one switch fabric card at a time can misalign the chassis and may damage the card or chassis when reinserting the cards. Remove and reinsert only one card at a time.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove a switch fabric card, see Figure 4-20 and follow these steps:

Figure 4-20   Removing a Switch Fabric Card
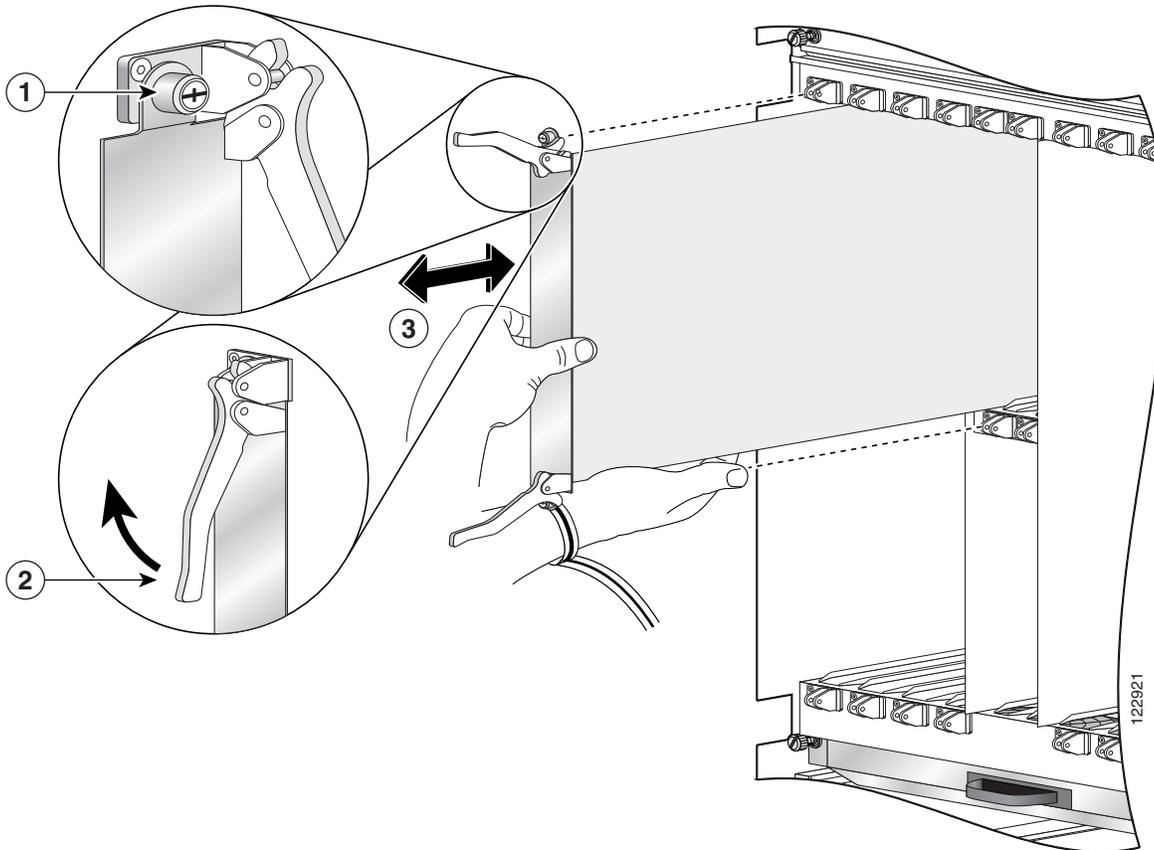
1	Captive screw	3	Direction of installation or removal
2	Ejector lever		

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2 Identify the switch fabric card to be removed from the card cage.

Step 3 To loosen the card from the slot, turn the two captive screws on the front panel of the card counterclockwise.

Step 4 To unseat the card from the midplane connector, grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees (70 degrees for a newer switch fabric card) away from the front edge of the card carrier.

Step 5 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in its original shipping container.

What to Do Next

After performing this task, replace any front cover plates.

Verifying the Installation of a Switch Fabric Card

This section describes how to verify that a switch fabric card has been properly installed. Figure 4-21 shows the switch fabric card front panel.

Figure 4-21   Switch Fabric Card Front View
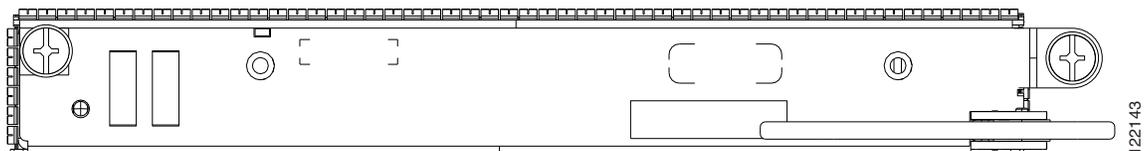
Understanding the Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, a switch fabric card has an alphanumeric LED display that shows a sequence of messages indicating the state of the card.

> **Note** It is normal for some displayed messages to appear too briefly in the LED display to be read.

Troubleshooting the Switch Fabric Card

If the installed or replaced switch fabric card fails to operate or to power up on installation:

1. Make sure that the card is seated firmly in the Cisco CRS 8-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the switch fabric card is even with the fronts of the other cards installed in the card cage.

2. Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the switch fabric card.

3. Examine the alarm LEDs on the RP to see if there are any active alarm conditions.

4. Examine the power shelves to see whether the chassis, as a whole, is receiving power.

Switch Fabric Card Status LEDs

Use the status LEDs, located on the switch fabric card faceplate, to verify the correct installation of the card:

- When the card is properly installed, the Status turns green. If this LED is off, verify that the card is installed correctly.

- When the Status is blinking yellow, a problem exists on the board.

- When the Status is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.

- If there is a failure during the board boot sequence, the two-row, four-character alphanumeric display indicates the current boot phase to assist you in debugging the board failure.

How to Install or Remove an MSC, FP, or LSP

This section contains the following procedures:

- Installing an MSC, FP, or LSP, page 4-29

- Removing an MSC, FP, or LSP, page 4-33

- Verifying the Installation of an MSC, FP, or LSP, page 4-36

Installing an MSC, FP, or LSP

This section describes how to install an MSC, FP, or LSP line card in the Cisco CRS 8-slot line card chassis. For more detailed information on the line card , see *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

The MSC, FP, and LSP line cards are Layer 3 forwarding engines in the Cisco CRS Series routing system (see Figure 4-22). A line card can be paired with different types of physical layer interface modules (PLIMs) to provide a variety of interfaces.

- The MSCs include: CRS-MSC, CRS-MSC-B, CRS-MSC-140G, and CRS-MSC-X (200G).

- The FPs include: CRS-FP-140, CRS-FP-X (200G).

- The LSP is: CRS-LSP.

A line card fits into any available MSC slot and connects directly to the midplane. If you install a new line card, you must first remove the MSC impedance carrier from the available slot.

Figure 4-22 shows the CRS-MSC-140G MSC. The other MSC, FP, and LSP cards are similar.

Figure 4-22   *Modular Services Card (CRS-MSC)*

Prerequisites

> ✎
> **Note** See Chapter 1, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Overview," for information on MSC slot types, numbers, widths, and locations.

> ⚠
> **Caution** Remove or install only one line card at a time. Allow at least 15 seconds for the router to complete the preceding tasks before removing or installing another line card. The router may indicate a hardware failure if you do not follow proper procedures.

> ⚠
> **Caution** Do not carry an MSC by the bracket attached to the faceplate.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Medium flat-blade or Phillips screwdriver
- MSC, FP, or LSP line card (see the product data sheet for ordering details).

Steps

To install a line card, see Figure 4-23 and follow these steps:

Figure 4-23   *Installing an MSC*
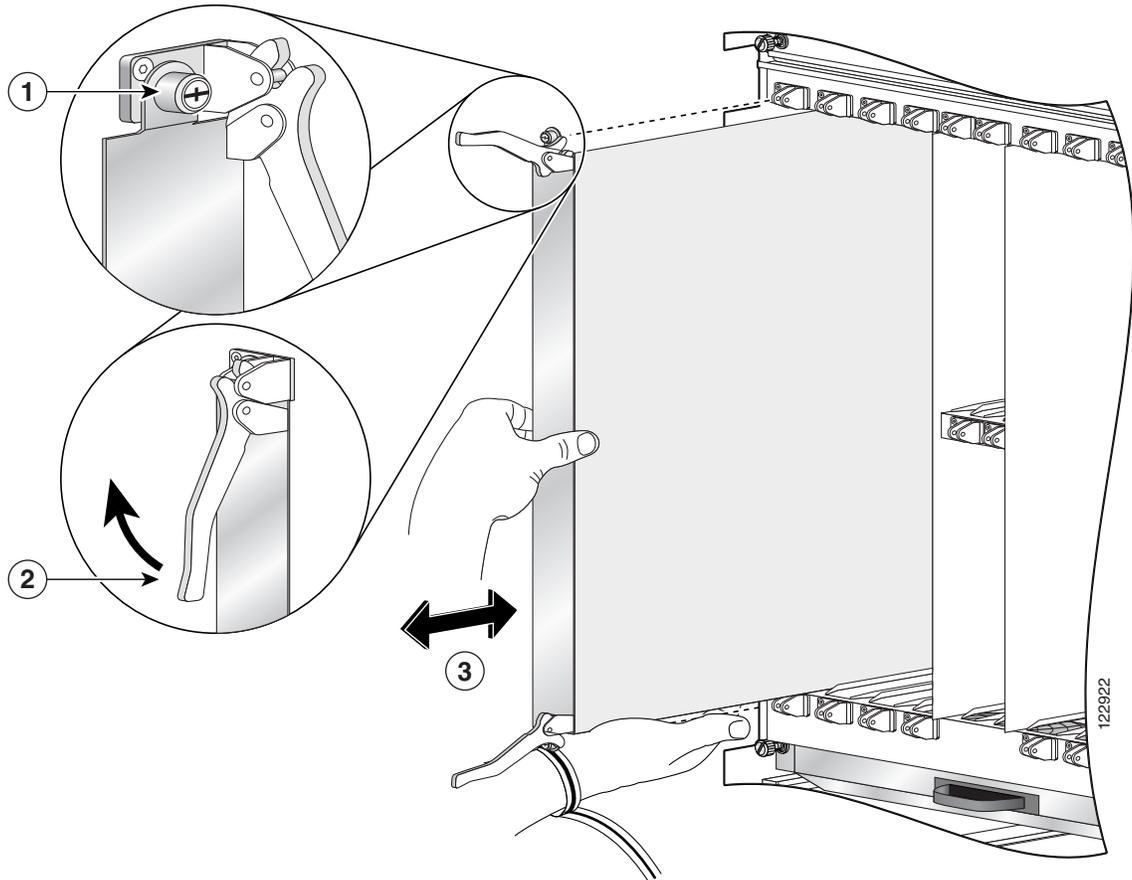
1	Captive screw	3	Direction of installation or removal
2	Ejector lever		

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2   Choose an available MSC slot for the MSC.

⚠️

Caution   To prevent ESD damage, handle a line card by its ejector levers or the card carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 3   Remove the MSC impedance carrier from the slot you need to fill and set it aside.

✎

Note   Remove only one impedance carrier and install one MSC at a time. Be sure to verify that each line card is fully installed and secured before installing another card.

Step 4   Remove the line card you are installing from its antistatic packaging.

Step 5 Visually inspect the connector on the card before you insert it into the chassis. Do not attempt to install a card with a damaged connector, as this action may damage the chassis midplane pins.

Step 6 Use both hands while inserting an line card. Use one hand on the faceplate and the other hand along the base of the line card to guide it into a slot.

Step 7 Orient the line card so that the PCB faces left and the carrier is to the right; if the card does not slide easily into the slot, the orientation may be wrong and the misorientation rejection flange is stopping the card from going into the slot. Reorient the line card, if necessary.

Step 8 Make sure that the ejector levers are oriented properly to engage with the pin as the line card slides into the slot. Carefully slide the line card into the slot until the ejector levers engage the catches, then *stop.*

Step 9 Simultaneously pivot the ejector levers toward the faceplate of the line card. Do not force the line card; the ejector levers properly seat the line card against the midplane.

> **Note** If the captive screws are difficult to tighten, check to ensure that each ejector lever is properly secured to each catch and that the line card is properly seated in the slot.

Step 10 Partially tighten the two captive screws on the front panel of the card (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 11 Use a screwdriver to fully tighten the captive screws next to each line card ejector lever to ensure proper EMI shielding and to prevent the card from becoming partially dislodged from the midplane.

> **Caution** To ensure adequate space for additional PLIMs or line cards, always tighten the captive installation screws on each newly installed PLIM *before* you insert another PLIM or line card. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the system.

Step 12 Attach the bracket to the line card; use the screws that came with it.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- Replace any front cover cosmetic plates and verify that the card has been installed properly (see the "Verifying the Installation of an MSC, FP, or LSP" section on page 4-36).
- If you are performing the initial installation of the system, install the RP cards (see the "How to Install or Remove an RP, PRP, or DRP PLIM" section on page 4-38).

Removing an MSC, FP, or LSP

This section describes how to remove a line card from the Cisco CRS 8-slot line card chassis. For more detailed information on the line cards, see *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.
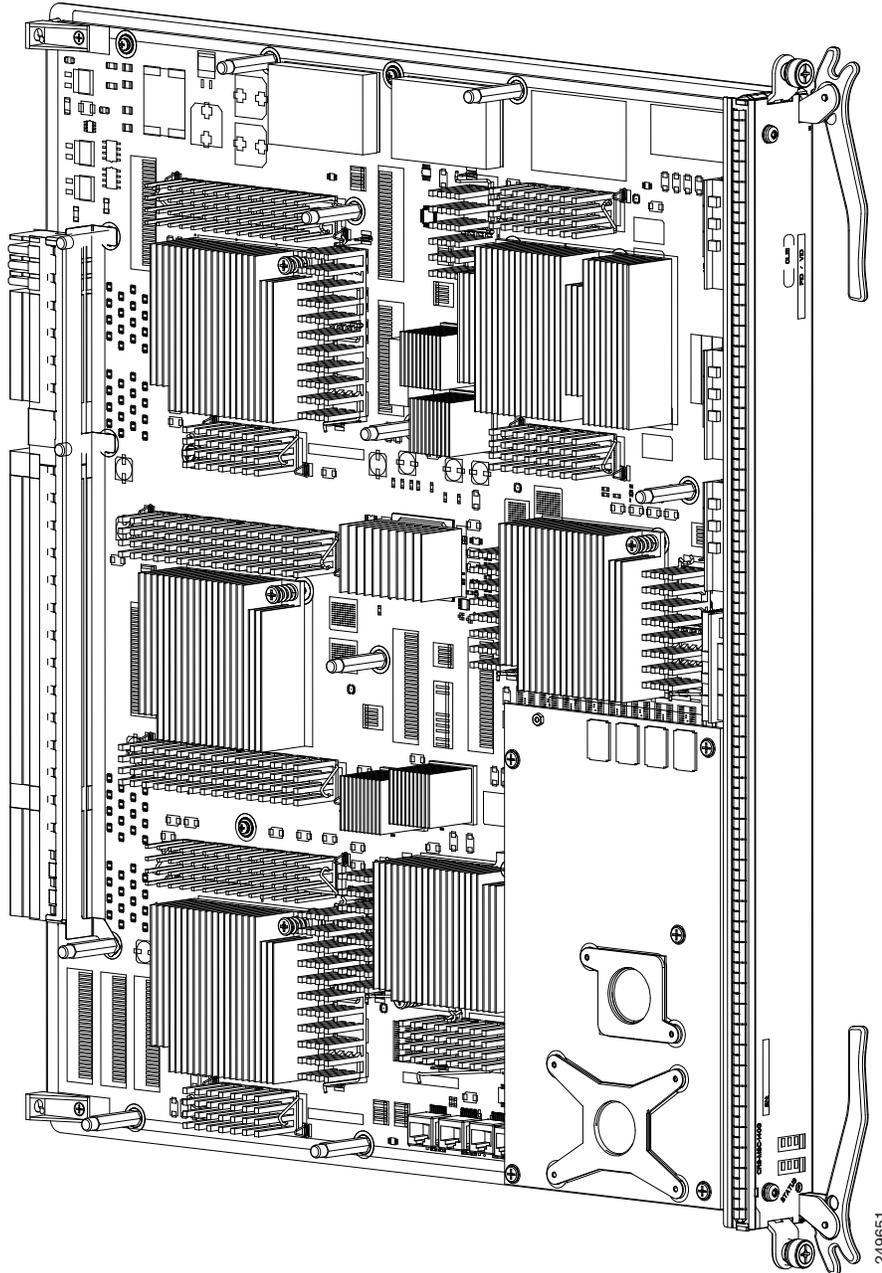
Prerequisites

Note For information on MSC slot types, numbers, widths, and locations see Chapter 1, "Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Overview."

Caution Use the cable management bracket to slide cards from the card carrier. *Do not lift cards by the cable management bracket*! Rotate cards onto their vertical axes, then lift them from the bottom, using the cable management bracket only as an aid for balance.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Medium flat-blade or Phillips screwdriver
- Impedance carrier (Cisco Product number CRS-MSC-IMPEDENCE=)

Steps

To remove an MSC, FP, or LSP line card, see Figure 4-24 and follow these steps:

Figure 4-24   *Removing a Line Card*
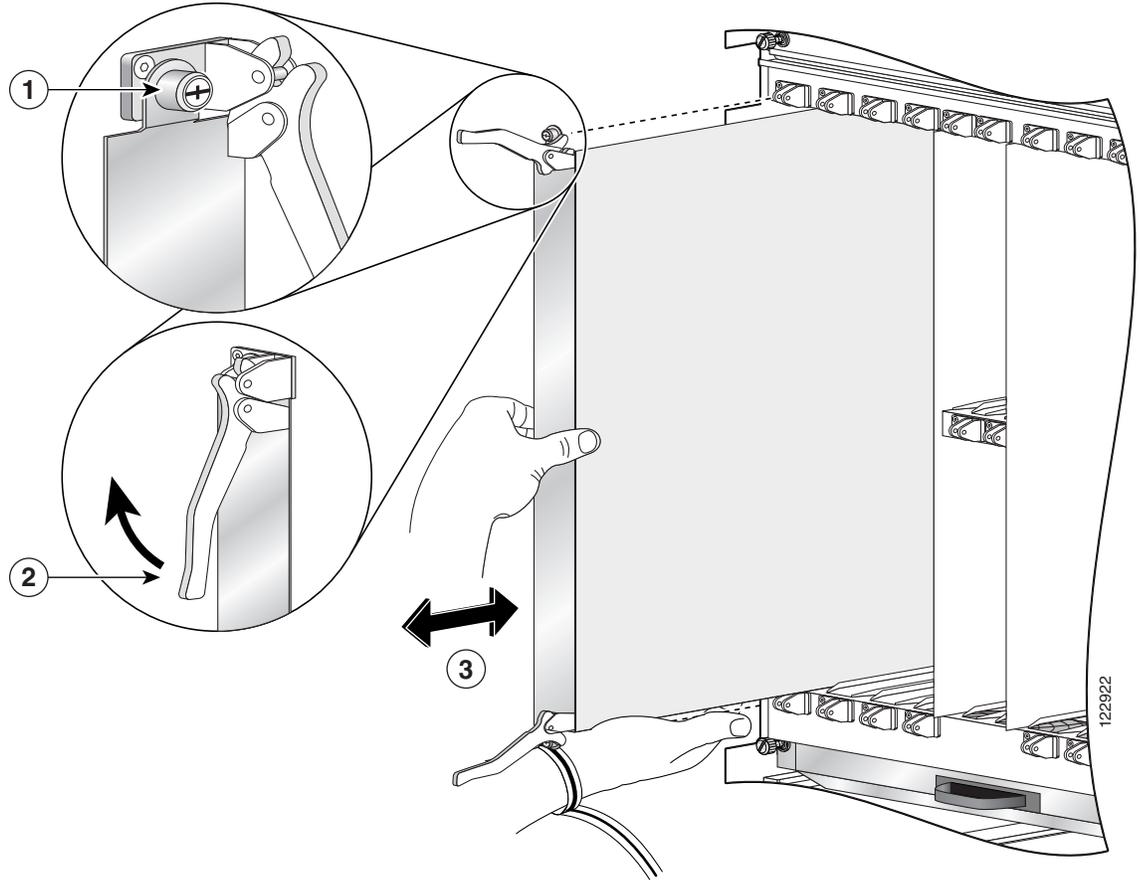
1	Captive screw	3	Direction of installation or removal
2	Ejector lever		

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the rear (MSC) side or a bare metal surface on the chassis.

Step 2   Use a screwdriver to loosen the captive screw next to each MSC ejector lever.

⚠

Caution   To prevent ESD damage, handle a line card by its ejector levers or the card carrier edges only. Do not touch any of the electrical components, pins, or circuitry.

Step 3   Simultaneously pivot the ejector levers away from the faceplate to release the line card from the midplane connectors.

Step 4   Grasp the cable management bracket and gently pull the line card halfway from the slot.

Step 5   Move one hand under the line card to guide it.

Avoid touching the line card printed circuit board, components, or any connector pins. *Do not lift cards by the cable management bracket*—lift the cards from the bottom, using the cable management bracket only as an aid for balance.

Step 6   Place the removed line card on an antistatic mat, or immediately place it in an antistatic bag if you plan to return it to the factory.

Step 7   If the MSC slot is to remain empty, install an MSC impedance carrier to keep dust from the chassis and maintain proper airflow through the MSC compartment.

Step 8   Use a screwdriver to tighten the captive screws next to each impedance carrier ejector lever to ensure proper EMI shielding and to maintain proper airflow throughout the chassis.

What to Do Next

If you did not place the line card in an antistatic bag, do so now for storage and future use.

Verifying the Installation of an MSC, FP, or LSP

This section describes how to verify that a line card has been properly installed.

Figure 4-25 is an illustration of the MSC-140G front panel.

Figure 4-25   ***CRS-MSC-140G Front Panel***
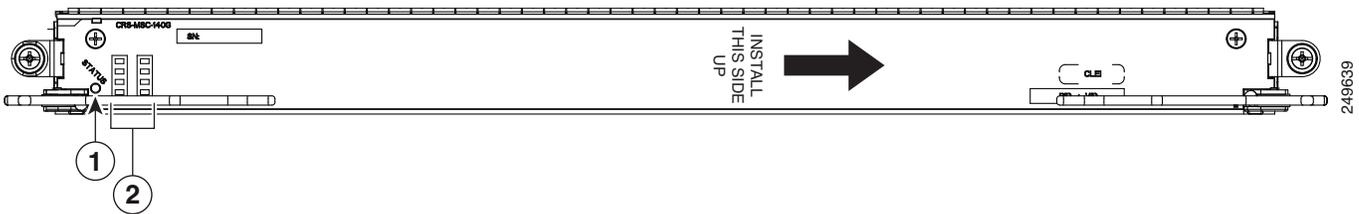
1	Status LED	2	Alphanumeric LEDs

Figure 4-26 shows the FP-140 FP face panel.

Figure 4-26   ***CRS-FP140 Front Panel***
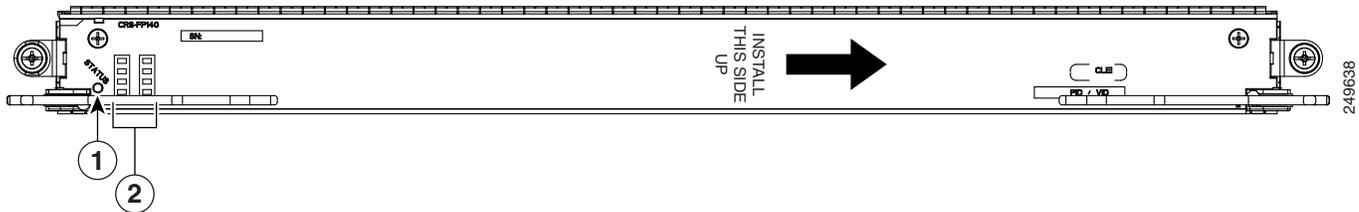
1	Status LED	2	Alphanumeric LEDs

Figure 4-27 shows the CRS-LSP front panel.

Figure 4-27   *CRS-LSP Front Panel*
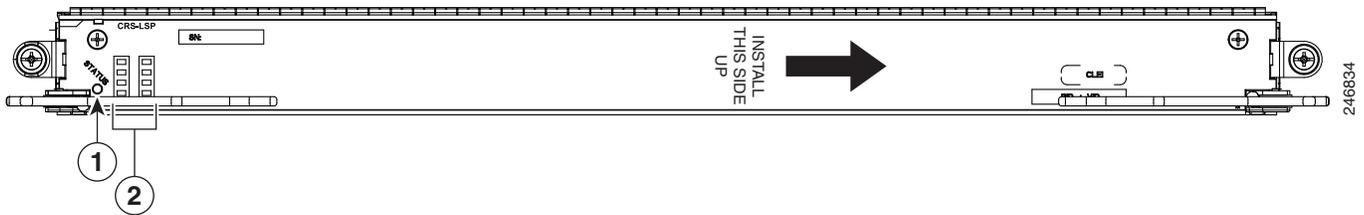
| 1 | Status LED | 2 | Alphanumeric LEDs |

Understanding the Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, a line card has two four-digit alphanumeric LED displays that show a sequence of messages indicating the state of the card.

Note   It is normal for some displayed messages to appear too briefly in the LED display to be read.

Troubleshooting the MSC, FP, or LSP

If the installed or replaced line card fails to operate or to power up on installation:

1. Make sure that the card is seated firmly in the Cisco CRS 8-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the MSC is even with the fronts of the other cards installed in the card cage.

2. Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the MSC.

3. Examine the Cisco CRS 8-slot line card chassis alarm LEDs on the RP to see if there are any active alarm conditions.

4. Examine the Cisco CRS 8-slot line card chassis power distribution units (PDUs) to see whether the chassis, as a whole, is receiving power.

Status LEDs

Use the status LEDs, located on the line card faceplate, to verify the correct installation of the card:

- When the card is properly installed, the Status LED turns green. If this LED is off, verify that the card is installed correctly.
- When the Status LED is blinking yellow, a problem exists on the board.
- When the Status LED is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.

How to Install or Remove an RP, PRP, or DRP PLIM

This section contains the following procedures:

For more detailed information on the route processor card, see *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

Installing an RP, PRP, or DRP Card

This section describes how to install a route processor (RP), performance route processor (PRP), or distributed route processor (DRP) card in the chassis.

Every Cisco CRS 8-slot line card chassis contains two RP cards in dedicated slots on the front (PLIM) side of the chassis (see Figure 4-28).

> **Note**   A chassis may not be populated with a mix of RP and PRP cards. Both route processor cards should be of the same type (RP or PRP). If you are using the Cisco CRS-X system, you must use PRP cards only.

> **Note**   For enhanced immunity to external electromagnetic disturbance levels of 10V per meter and 10 V RMS, you must use a shielded Ethernet (CAT5 or better STP) cable on the Management Ethernet connection of the RP card (CRS-8-RP). The use of a shielded Ethernet cable on the Management Ethernet connection of the PRP card (CRS-8-PRP-6G or CRS-8-PRP-12G) is optional. The grounded end of the shielded Ethernet cable should be at the RP (or PRP) end.

Prerequisites

Because chassis operation may be impacted by the installation of a route processor card, perform these tasks only if one of the following conditions exists:

- When you are certain that the second RP in the chassis is operational and, if not already the active RP, ready to assume control (this happens automatically)
- When the chassis is undergoing scheduled maintenance
- When the Cisco CRS 8-slot line card chassis is powered down

Failure to follow these guidelines can result in interruptions in data communications and network connectivity.

Figure 4-28   Route Processor (RP) Card for the 8-Slot Chassis
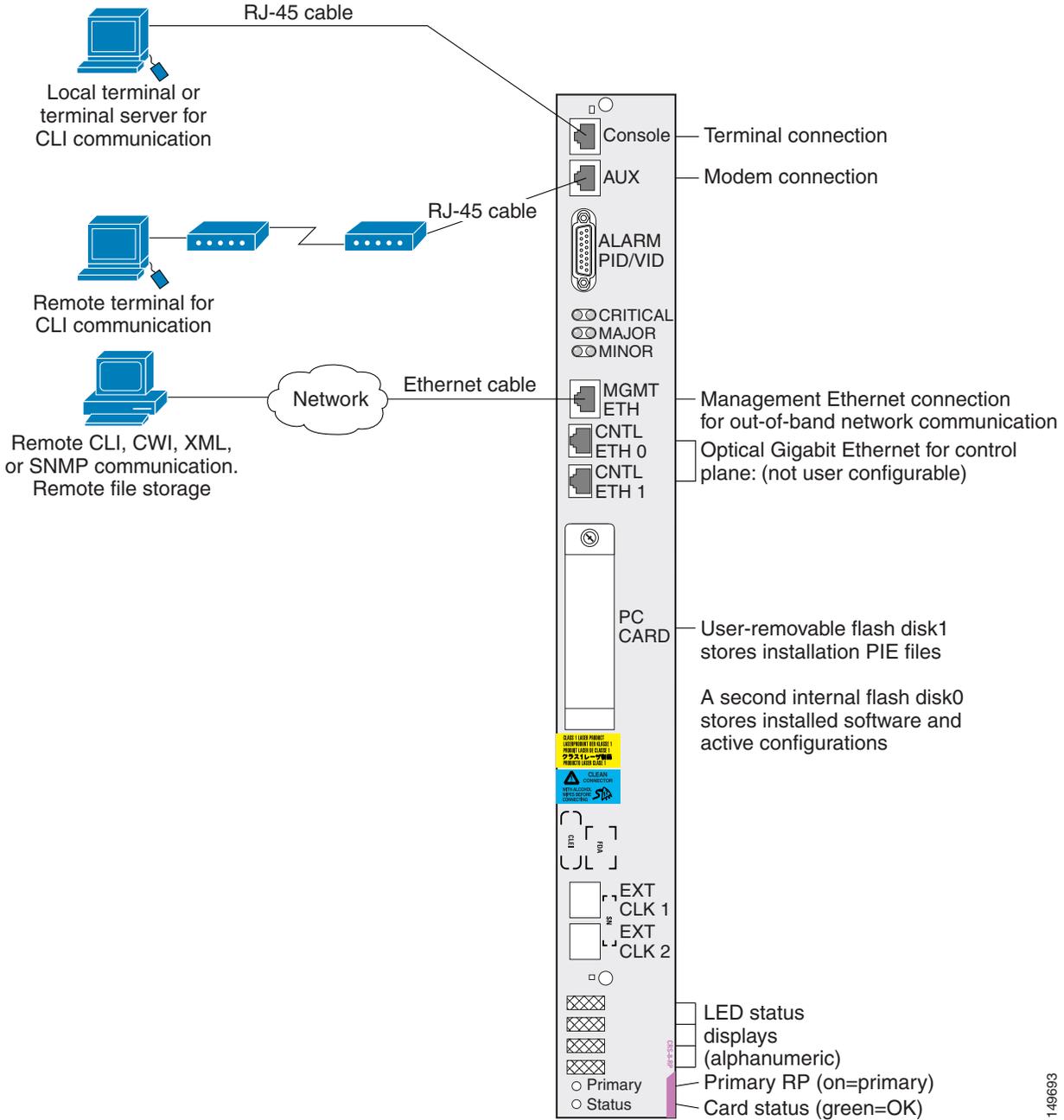
Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver.
- RP, PRP, or DRP card:
    - RP card—Cisco product number: CRS-8-RP=
    - PRP card—Cisco product number: CRS-8-PRP-6G=
    - PRP card—Cisco product number: CRS-8-PRP-12G=
    - DRP card—Cisco product number: CRS-DRP-CPU=

Steps

To install an RP or DRP card, follow these steps:

Step 1 Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2 Remove the card from its antistatic packaging.

Step 3 Visually inspect the connector pins on the card before you insert it into the chassis. Do not attempt to install a card with bent pins, as this may damage the chassis midplane connectors.

Step 4 Identify the card to be replaced in the card cage. Remove any cables connected to the front panel of the card.

Step 5 Use the screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Step 6 Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 7 Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in the shipping container you received with the replacement card.

Step 8 Grasp the card carrier handle with one hand and place your other hand under the carrier to support and guide it into the correct slot. Slide the card halfway into the slot. Avoid touching the card circuitry or any connectors.

> ✎
> **Note**   Alignment grooves exist on each slot in the card cage. When you install a card in the card cage, make sure that you align both edges of the card carrier in the slot grooves.

Step 9 Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

> ⚠
> **Caution**   Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the ejector levers, thereby damaging or breaking one or both ejector levers.

Step 10 Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

> **Note** An RP or DRP card has guide pins that make initial contact with the backplane connector as you slide the card into its slot. After the guide pins make contact, continue pushing on the card carrier until the card ejector levers begin pivoting forward, toward the handle in the card carrier.

Step 11 To seat the card in the backplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

Step 12 Partially tighten the two captive screws on the front panel of the card (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 13 Use the screwdriver to turn the two captive screws on the front panel of the card clockwise to seat the card firmly in the slot.

Step 14 Reattach any cables you removed in Step 3.

What to Do Next

After performing this task:

- Place the impedance carrier in an antistatic bag for storage and future use.
- Replace any front cover cosmetic plates and verify that the card has been installed properly (see the "Verifying the Installation of an RP, PRP, or DRP Card" section on page 4-43).
- If you are performing the initial installation of the system, install the PLIMs (see the "Installing a PLIM" section on page 4-47).

Removing an RP, PRP, or DRP Card

This section describes how to remove a route processor (RP), performance route processor (PRP), or distributed route processor (DRP) card from the chassis. For more detailed information on the route processor card, see *Cisco CRS Series Carrier Routing System 8-Slot Line Card Chassis System Description*.

Every Cisco CRS 8-slot line card chassis contains two route processor cards in dedicated slots on the front (PLIM) side of the chassis (see Figure 4-28).

> **Note** For enhanced immunity to external electromagnetic disturbance levels of 10V per meter and 10V RMS, you must use a shielded Ethernet (CAT5 or better STP) cable on the Management Ethernet connection of the RP card (CRS-8-RP). The use of a shielded Ethernet cable on the Management Ethernet connection of the PRP card (CRS-8-PRP-6G or CRS-8-PRP-12G) is optional. The grounded end of the shielded Ethernet cable should be at the RP (or PRP) end.

Prerequisites

Because chassis operation may be impacted by the removal of an RP card, perform these tasks only if one of the following conditions exists:

- When you are certain that the second RP in the chassis is operational and, if not already the active RP, ready to assume control (this happens automatically)
- When the chassis is undergoing scheduled maintenance
- When the Cisco CRS 8-slot line card chassis is powered down

Failure to follow these guidelines can result in interruptions in data communications and network connectivity.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Large Phillips screwdriver

Steps

To remove an RP or DRP card, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Identify the card to be removed from the card cage. Remove any cables connected to the front panel of the card.

Step 3   Use the screwdriver to turn the two captive screws on the front panel of the card counterclockwise to loosen the card from the slot.

Step 4   Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 5   Touching only the metal card carrier, slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container. If you plan to return the defective card to the factory, repackage it in the shipping container you received with the replacement card.

What to Do Next

After performing this task, replace any front cover plates.

Verifying the Installation of an RP, PRP, or DRP Card

This section describes how to verify and troubleshoot the installation of a route processor (RP) or distributed route processor (DRP) card in the Cisco CRS 8-slot line card chassis. For more detailed information on the RP card, see *Cisco CRS Series Carrier Routing System 8-Slot Line Card Chassis System Description*.

This section describes how to verify that the card has been properly installed. Status indicators on the RP front panel include:

- Alphanumeric LED display
- Status OK LED
- Active/Standby LED

Figure 4-29 shows the RP card front panel.

Figure 4-29   RP Card Front Panel
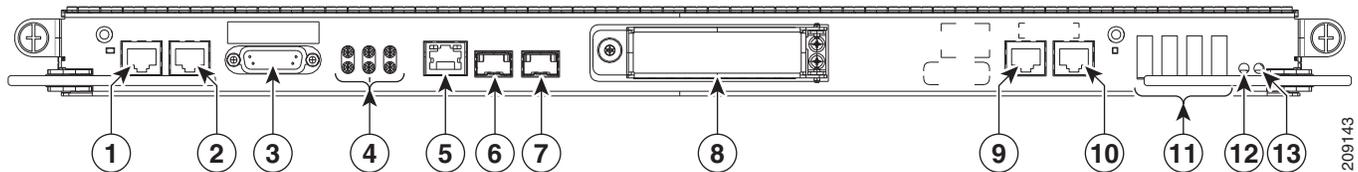
1	Console port	**6**	Control Ethernet 0 port	**11**	Alphanumeric LEDs
2	AUX port	**7**	Control Ethernet 1 port	**12**	PRIMARY LED
3	Alarm connector	**8**	PC card slot	**13**	STATUS LED
4	Alarm LED array	**9**	EXT CLK 0 port		
5	Management Ethernet port	**10**	EXT CLK 1 port		

Figure 4-30 shows the PRP card front panel.

Figure 4-30   *PRP Card Front Panel*
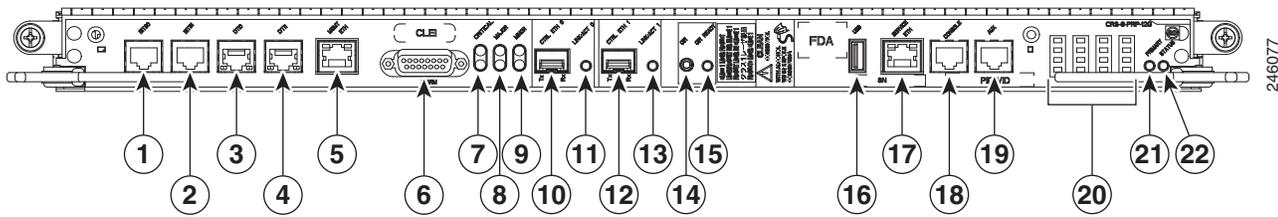
1	BITS 0	12	Control Ethernet 1 port (SFP or SFP+)
2	BITS 1	13	Link/Active 1 LED
3	DTI 0	14	OIR push button—Press to initiate OIR process
4	DTI 1	15	OIR Ready LED
5	Management Ethernet RJ45 port	16	USB socket
6	Alarm connector	17	Service Ethernet RJ45 port
7	Critical Alarm LED	18	Console port
8	Major Alarm LED	19	Auxiliary port
9	Minor Alarm LED	20	Alphanumeric LED Display
10	Control Ethernet 0 port (SFP or SFP+)	21	PRIMARY LED—PRP active or standby indicator
11	Link/Active 0 LED	22	STATUS LED—Card status indicator

Understanding the Alphanumeric LEDs

At one end of the faceplate, near an ejector lever, an RP, PRP, or DRP card has an alphanumeric LED display that shows a sequence of messages indicating the state of the card.

Note   It is normal for some displayed messages to appear too briefly in the LED display to be read.

Troubleshooting the RP, PRP, or DRP Card

If the installed or replaced card fails to operate or to power up on installation, do the following:

1. Make sure that the card is seated firmly in the Cisco CRS 8-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the card is even with the fronts of the other cards installed in the card cage.

Note   PRP cards only—If the PRP is not seated properly, the blue OIR Ready LED on the faceplate glows solidly, and the Primary and Status LEDs keep blinking to indicate that the card is not seated correctly. If this happens, remove the card fully and re-insert fully.

2. Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the card.

3. Examine the alarm LEDs on the to see if there are any active alarm conditions.

4. Examine the power shelves to see whether the chassis, as a whole, is receiving power.

Status LEDs

Use the status LEDs, located on the card faceplate, to verify the correct installation of the card:

- When the card is properly installed, the Status LED turns green. If this LED is off, verify that the card is installed correctly.

- When the Status LED is blinking yellow, a problem exists on the board.

- When the Status LED is off, the board state is unknown. Verify that there is power to the board by looking at the indicators on the power module.

- When the Primary LED is on, the board is executing control processing functions and is not in a secondary or standby role.

- If there is a failure during the board boot sequence, the four-row, four-character alphanumeric display indicates the current boot phase to assist you in debugging the board failure.

How to Install or Remove a PCMCIA Card

This section contains the following procedures:

- Installing a PCMCIA Card, page 4-45
- Removing an RP PCMCIA Card, page 4-46

Installing a PCMCIA Card

This section describes how to install a PCMCIA card in an RP or a DRP card PCMCIA slot. For more detailed information on PCMCIA cards, see the "Information About Hard Drives and PCMCIA Cards" section on page 4-12, or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*. Figure 4-31 shows you the location of the PCMCIA door in the RP card faceplate. (The PCMCIA cards for the DRP are in a similar location.)

Note   Only disk1: can be installed in or removed from the CRS 8-slot line card chassis Route Processor.

Figure 4-31   RP Card PCMCIA Slot Door
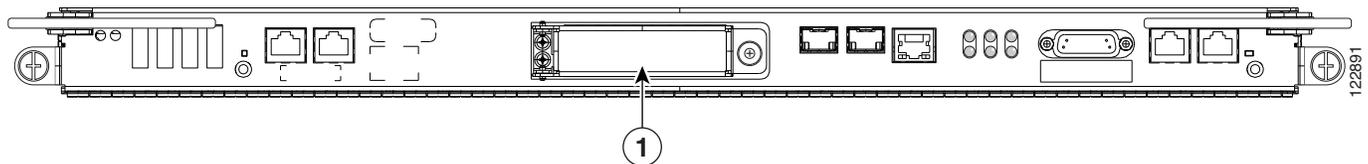
1	PCMCIA flip-up door

✎

Note   Only the original route processor (RP) card uses a PCMCIA card. The performance route processor (PRP) card has a USB connector for using a flash drive.

Prerequisites

If you are replacing a PCMCIA card, see the "Removing an RP PCMCIA Card" section on page 4-46 to remove the PCMCIA card from the PCMCIA card slot.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive strap
- Medium flat-head screwdriver
- PCMCIA card

Steps

To install a PCMCIA card, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Using the screwdriver, loosen the captive screw at the bottom of the PCMCIA slot door on the faceplate of the card.

Step 3   While lifting the hinged PCMCIA slot door up, carefully insert the new PCMCIA flash card into the left slot of the PCMCIA card cage.

When the card is fully inserted, the release button pops up. (If the button fails to pop up, you may not have the card in right side up; turn the card over and try again.)

Step 4   Close the door to keep dust out, and tighten the captive screw.

What to Do Next

After performing this task, replace any front (PLIM) side cover plates.

Removing an RP PCMCIA Card

This section describes how to remove a PCMCIA card from an RP or a DRP card PCMCIA slot. For more detailed information on PCMCIA cards, see the "Information About Hard Drives and PCMCIA Cards" section on page 4-12, or *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*.

Figure 4-31 shows you the location of the PCMCIA door in the RP card faceplate. (The PCMCIA cards for the DRP are in a similar location.)

Prerequisites

Before performing this task, remove any front (PLIM) side cover plates.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive strap
- Medium Phillips screwdriver

Steps

To remove the PCMCIA card, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Using the screwdriver, loosen the captive screw at the bottom of the PCMCIA slot door on the faceplate of the card.

Step 3   While lifting the hinged PCMCIA slot door up, press the release button for the card slot to disengage the card from the card.

Step 4   Carefully pull out the far-left removable PCMCIA flash card.

Step 5   Place the removed PCMCIA card on an antistatic mat, or place it in an antistatic bag if you plan to return it to the factory.

Step 6   If the PCMCIA card slot is to remain empty, close the door to keep dust out, and tighten the captive screw with the screwdriver. Otherwise, install the new PCMCIA card.

What to Do Next

If you intend to install a new PCMCIA card, see the .

How to Install or Remove a Physical Layer Interface Module

This section contains the following procedures:

Installing a PLIM

This section describes how to install a PLIM in the Cisco CRS 8-slot line card chassis. For more detailed information on PLIMs, see the *Cisco CRS Series Carrier Routing System 8-Slot Line Card Chassis System Description*.

A physical layer interface module (PLIM) is paired with an MSC through the midplane of the chassis. A PLIM provides the ability to choose several interfaces. Figure 4-32 shows a typical PLIM (in this case a 14-port 10-GE XFP PLIM).

Figure 4-32   Typical Physical Layer Interface Module (a 14-port 10-GE XFP PLIM)
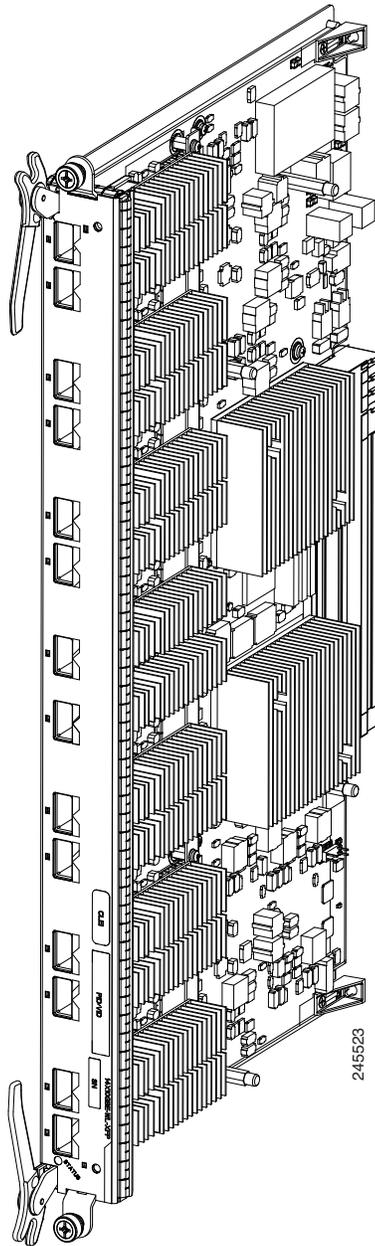
⚠

Caution   The system may indicate a hardware failure if you do not follow proper procedures. Remove or install only one PLIM at a time. Allow at least 15 seconds for the system to complete the preceding tasks before removing or installing another PLIM.

Prerequisites

Before performing this task, remove any front cover plates.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Medium Phillips screwdriver
- PLIM

Steps

To install a PLIM, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Remove the PLIM from its antistatic packaging.

Step 3   Visually inspect the connector pins on the card before you insert it into the chassis. Do not attempt to install a card with bent pins, as this may damage the chassis midplane connectors.

Step 4   Remove the PLIM impedance carrier from the slot you need to fill and set it aside.

> **Note**   Remove only one impedance carrier and install one PLIM at a time. Be sure to verify that each PLIM is fully installed and secured before installing another card.

Step 5   Grasp the card carrier handle with one hand and place your other hand under the carrier to support and guide it into the correct slot. Slide the card halfway into the slot. Avoid touching the card circuitry or any connectors (see Figure 4-33).

Figure 4-33   *Installing a PLIM*
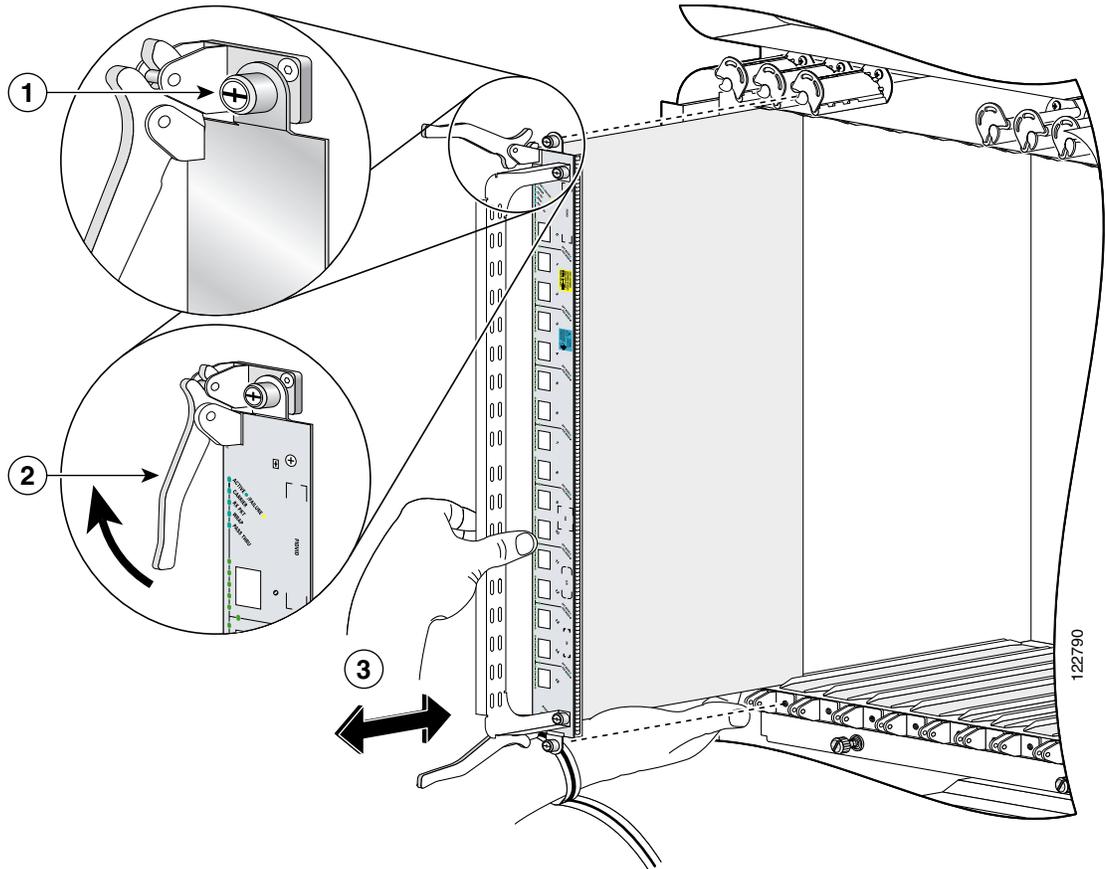
1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 6 Pivot both card ejector levers so that the openings on the card ejector cams at the top and bottom of the card pass over the tabs on each side of the card cage slot.

⚠️

Caution Verify that the openings on the card ejector cams pass over the tabs; otherwise, one or both ejector levers may bind when you attempt to close the ejector levers, thereby damaging or breaking one or both ejector levers.

Step 7 Continue sliding the card into the card cage slot until the openings on the card ejector cams engage the tabs on each side of the card cage slot.

✎

Note Guide pins exist that make initial contact with the backplane connector as you slide a card into its slot. After the guide pins make contact, continue pushing on the card carrier until the card ejector levers begin pivoting forward, toward the handle in the card carrier.

Step 8   To seat the card in the midplane connector, grasp both card ejector levers and pivot them inward toward the handle in the card carrier until they are flush against the front edge of the card carrier.

Step 9   Partially tighten the two captive screws on the front panel of the card (either by hand or with the screwdriver) to make sure that they are both engaged.

Step 10   Tighten the captive screws on the PLIM.

⚠️

Caution   To ensure adequate space for additional PLIMs or line cards, always tighten the captive installation screws on each newly installed PLIM *before* you insert another PLIM or line card. These screws also prevent accidental removal and provide proper grounding and EMI shielding for the system.

Step 11   Install the SFP optical modules, if applicable (in a PLIM that uses an SFP module, such as the a 14-port 10-GE XFP PLIM).

Step 12   Install the PLIM cable management bracket.

Step 13   Install the interface cables.

⚠️

Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Some PLIMs contain Class 1 lasers, and some contain Class 1M. See the documentation for the specific PLIM for details.

What to Do Next

After performing this task, replace any grilles and chassis doors.

Removing a PLIM

This section describes how to remove a PLIM from the Cisco CRS 8-slot line card chassis. See Figure 4-32 for an example of a typical PLIM.

⚠️

Caution   The system may indicate a hardware failure if you do not follow proper procedures. Remove or install only one PLIM at a time. Allow at least 15 seconds for the system to complete the preceding tasks before removing or installing another PLIM.

✎

Note   We strongly recommend that you use the **shutdown** command before removing a PLIM to prevent anomalies when you reinstall a new or reconfigured PLIM.

Prerequisites

Before performing this task, remove any front cover plates.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Medium Phillips screwdriver

Steps

To remove a PLIM, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Identify the card to be replaced.

Step 3   Loosen the two captive screws holding the card in place.

Step 4   Grasp the two card ejector levers and simultaneously pivot both ejector levers 90 degrees (70 degrees for a newer PLIM) away from the front edge of the card carrier to unseat the card from the backplane connector.

Step 5   Grasp the handle and gently pull the PLIM halfway from the slot (see Figure 4-34):

Figure 4-34   Removing a PLIM
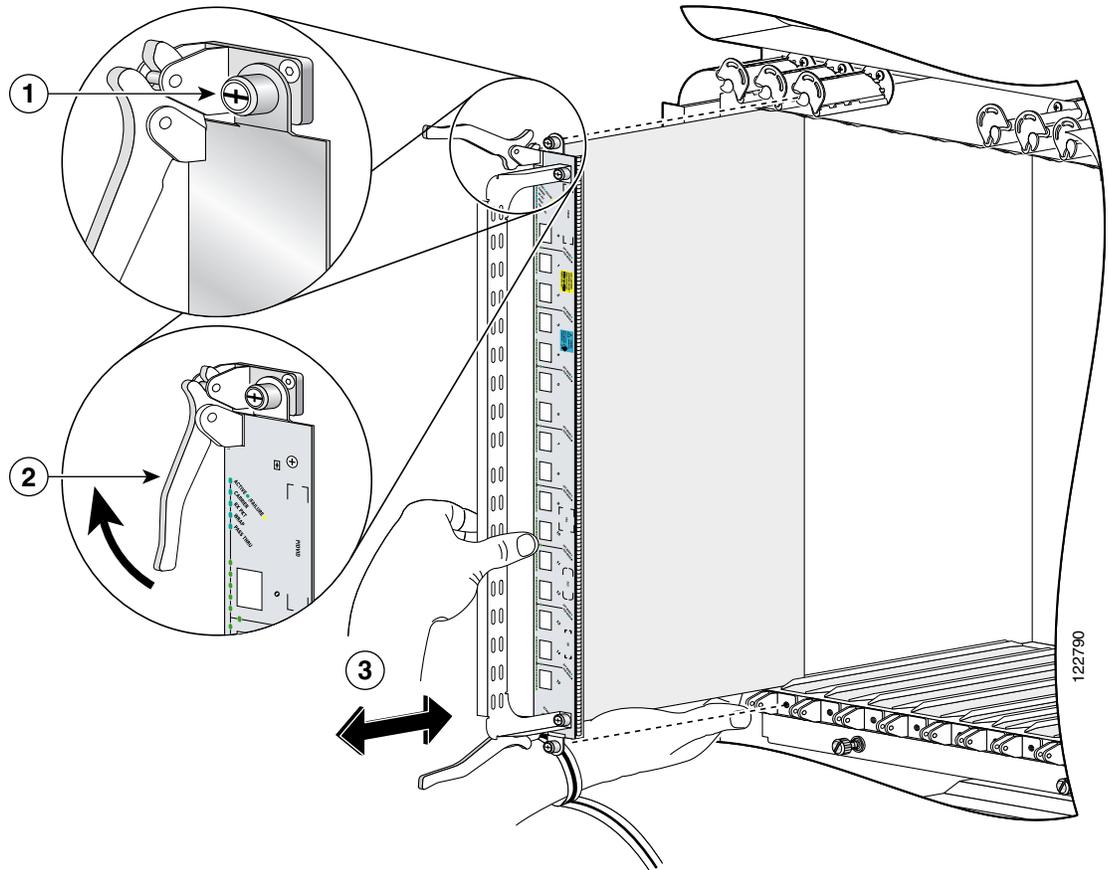
1	Captive screw	**3**	Direction of installation or removal
2	Ejector lever		

Step 6   Move one hand under the PLIM to guide it. Avoid touching the PLIM printed circuit board, components, or any connector pins.

Tip   *Do not lift cards by the handle*; lift from the bottom, using the handle only as an aid for balance.

Step 7   Slide the card from the slot and place it directly into an antistatic sack or other ESD-preventive container.

Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Some PLIMs contain Class 1 lasers, and some contain Class 1M. See the documentation for the specific PLIM for details.

What to Do Next

After performing this task, replace any front cover plates.

Verifying the Installation of a PLIM

This section describes how to verify that the PLIM has been properly installed.

Figure 4-35 shows the PLIM front panel (in this case, a 14-port 10-GE XFP PLIM).

Figure 4-35   ***PLIM Front Panel Indicators***
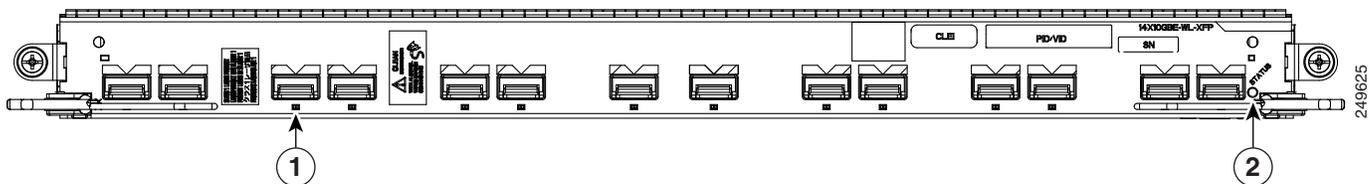
1	Port LED (one per port)	**2**	Status LED

Troubleshooting the PLIM

If the installed or replaced PLIM fails to operate or to power up on installation:

- Make sure that the PLIM is seated firmly in the Cisco CRS 8-slot line card chassis slot. One easy way to verify physical installation is to see whether the front faceplate of the PLIM is even with the fronts of the other PLIMs installed in the card cage.

- Check whether the ejector levers are latched and that the captive screws are fastened properly. If you are uncertain, unlatch the levers, loosen the screws, and attempt to reseat the PLIM.

- Examine the alarm LEDs on the RP to see if there are any active alarm conditions.

- Examine the power shelves to see whether the chassis, as a whole, is receiving power.

Use the status LEDs, located on the PLIM faceplate, to verify the correct installation of the card:

There are two types of LEDs on a PLIM: the board-level LED labeled **Status** and the port-level LEDs that are labeled differently depending on the PLIM type. When the PLIM is properly installed, the Status LED turns green. If this LED is off, verify that the associated MSC, FP, or LSP line card is installed correctly. For details on the information provided by the port-level LEDs, see the documentation specific to that PLIM.

How to Install or Remove a Small Form-Factor Pluggable (SFP) Module

This section contains the following procedures:

For general information about SFP modules, see the "Information About Small Form-Factor Pluggable (SFP) Modules" section on page 4-12. For information on SFP optical cleaning, see "Inspection and Cleaning Procedures for Fiber-Optic Connections," at the following URL:

http://www.cisco.com/warp/public/127/cleanfiber2.html

Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Installing a Bale-Clasp SFP Module

This section describes how to install a bale-clasp SFP module. The module has a clasp used to install and remove the module (see Figure 4-36).

Figure 4-36   *Bale-Clasp SFP Module*
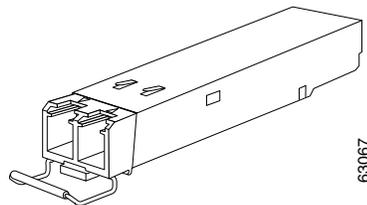
Prerequisites

Before installing a module, remove any front cover plates.

Required Tools and Equipment

You need the following tools and part to perform this task:

- ESD-preventive wrist strap
- Bale-clasp SFP module

Steps

To install a bale-clasp SFP module (into a PLIM), follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Close the bale clasp before inserting the module.

Step 3   Align the module with the port and slide it into the port (see Figure 4-37).

> ✎
> **Note**   Be careful to hold the module in such a way so as to not damage the bale clasp.

Figure 4-37   Installing a Bale-Clasp SFP Module into a Port
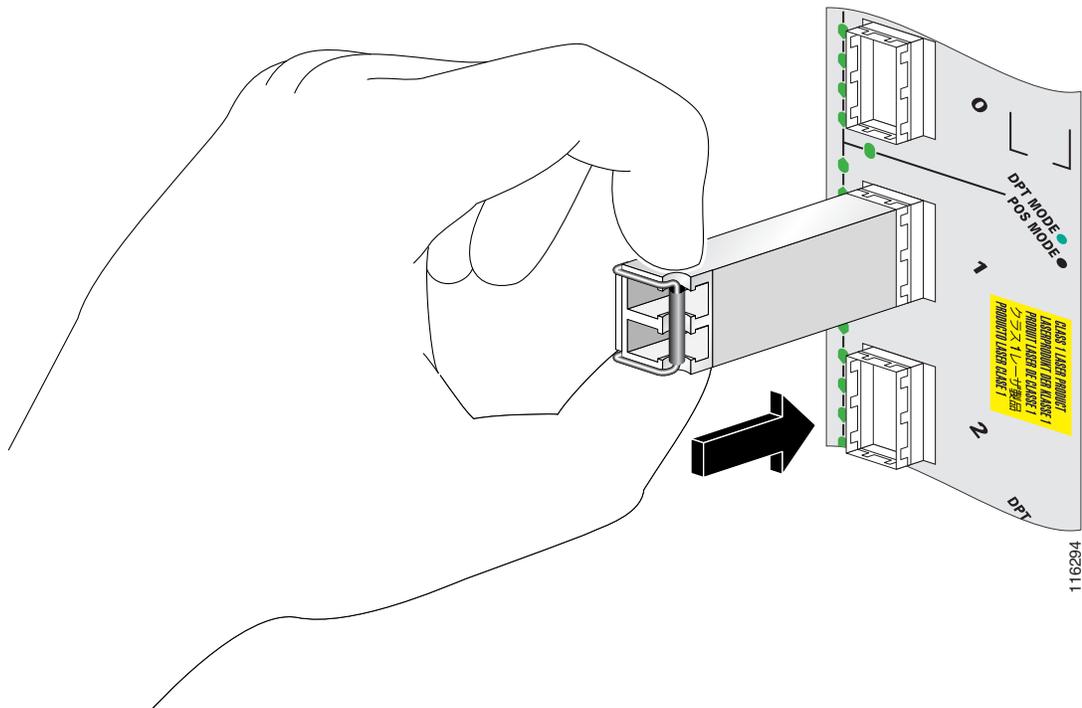
What to Do Next

After performing this task, replace any front cover plates.

Removing a Bale-Clasp SFP Module

This section describes how to remove a bale-clasp SFP module. The module has a clasp used to install and remove the module (see Figure 4-38).

Figure 4-38   Bale-Clasp SFP Module
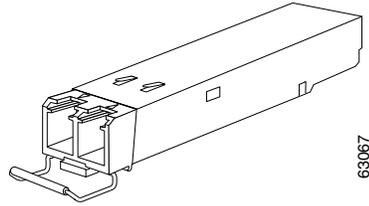
Prerequisites

Before removing a module, disconnect any connected interface cables.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Small flat-blade screwdriver

Steps

To remove a bale clasp SFP module (from a PLIM), follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket on the front (PLIM) side or a bare metal surface on the chassis.

Step 2   Disconnect and remove all interface cables from the ports. Be sure to note the current connections of the cables to the ports on the PLIM.

Step 3   Open the bale clasp on the module with your index finger in a downward direction (see Figure 4-39). If the bale clasp is obstructed and you cannot use your index finger to open it, use a small screwdriver or other long, narrow instrument to open the bale clasp.

Step 4   Grasp the module between your thumb and index finger and carefully remove it from the port (see Figure 4-39).

> **Note**   Be careful to hold the module in such a way so as to not damage the bale clasp.

Figure 4-39   *Removing a Bale-Clasp SFP Module*
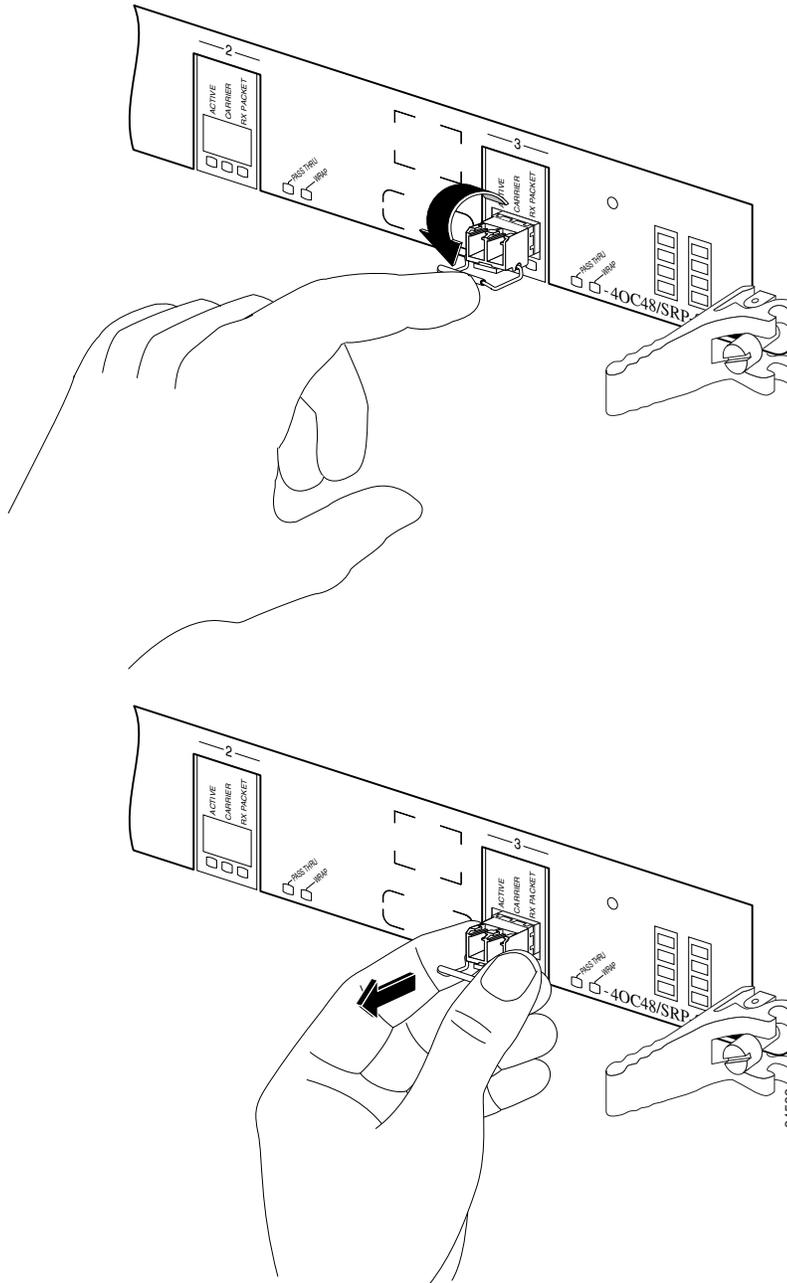
Step 5   If you plan to return it to the factory, place the removed module on an antistatic mat, or immediately place it in a static-shielding bag.

Step 6   Protect the PLIM by inserting clean SFP module cage covers into the optical module cage when there is no module installed.

What to Do Next

After performing this task, replace any front cover plates.

Replacing a SFP on a Line Card that Uses an Articulated Bracket

To replace a failed, defective, or retired SFP from a line card that is currently in service, and using an articulated cable management bracket, proceed as follows:

Step 1   For a line card with multiple articulated brackets, select the fibers to be removed from the bracket with the SFP to be removed.

For a line card with a single articulated bracket, begin with Step 2.

Step 2   Undo and remove the Velcro from the articulated bracket to release the fibers.

Step 3   From the physical location of the SFP to be removed, determine which end of the articulated bracket will be unscrewed:

- For the upper half of the line card, remove the top screw.

- For the lower half of the line card, remove the lower screw.

- If there is any interference with another installed bracket, choose the other screw location.

Step 4   Pivot the articulated bracket up or down, depending on which screw was removed.

Step 5   Label and disconnect the fibers from the port and put them aside.

Step 6   Remove the SFP.

Step 7   Replace with the new SFP (or a dust cap if the port is not going to be reused).

Step 8   Re-install the fibers that were removed in Step 5 per the labels.

Step 9   Pivot the articulated bracket back into position and secure.

Step 10   Re-dress and secure the fibers to the articulated bracket with Velcro.

CHAPTER 5

Installing and Removing Exterior Components

This chapter provides instructions for installing and removing the exterior cosmetic components on the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis. This chapter presents the following topics:

Overview of the Exterior Components

Exterior cosmetic components for the Cisco CRS 8-slot line card chassis are not required to be installed; they are provided as optional components (except for the cable management bracket, which is preinstalled). The 8-slot line card chassis is shipped with the following exterior components:

- Cable management bracket (shipped preinstalled on the chassis)
- Inlet grille (shipped separately)
- Front cover (shipped separately)

You can also install the optional exterior exhaust grille for the rear of the chassis. This exterior component for the rear of the chassis does not ship automatically with the product; it must be ordered separately.

Installing or Removing the Front Side Exterior Components

This section contains the following procedures:

Removing the Cable Management Bracket

The Cisco CRS 8-slot line card chassis arrives preinstalled with a horizontal cable management bracket on the front of the chassis and an optional horizontal cable management bracket available for the rear of the chassis. The cable management system organizes the interface cables that enter and exit the different cards, keeping them out of the way and free of sharp bends. This section describes how to remove a cable management bracket from the line card chassis.

⚠

Caution   Excessive bending of interface cables can damage the cables.

Figure 5-1   Cable Management Bracket
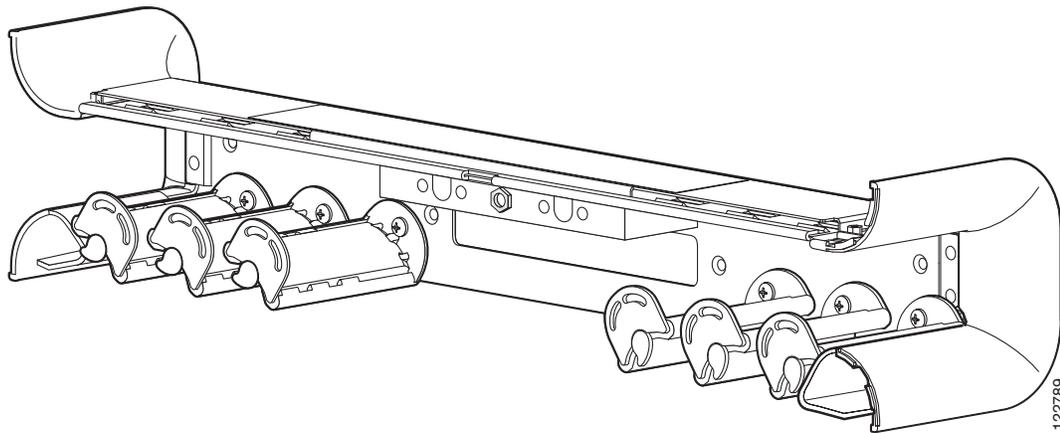
Prerequisites

The cable management bracket arrives preinstalled on the chassis. Remove any cables from the bracket before you begin removing it.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- 6 in. long number 1 Phillips screwdriver
- Medium flat-blade screwdriver

Steps

To remove the cable management bracket, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket or a bare metal surface on the chassis.

Step 2   If necessary, remove the Cisco logo bezel from the front of the chassis.

    a.   Gently insert the flat-blade screwdriver between the edge of the bezel and the face of the chassis and pry the bezel loose.

The bezel is attached to the front of the chassis with four ball studs.

b. Pull the bezel firmly towards you to detach it.

Step 3 Remove all screws on either side of the cable management bracket.

Tip For ease of removal, remove the outer screws first.

Caution Be careful not to damage the plastic bracket arms.

Step 4 Set the bracket carefully aside.

What to Do Next

You may now install a replacement cable management bracket, if necessary.

Reinstalling the Cable Management Bracket

The Cisco CRS 8-slot line card chassis arrives preinstalled with a horizontal cable management bracket on the front of the chassis and an optional horizontal cable management bracket available for the rear of the chassis. The cable management system organizes the interface cables that enter and exit the different cards, keeping them out of the way and free of sharp bends. If you need to reinstall the cable management bracket, this section describes how to install that bracket in the chassis.

Caution Excessive bending of interface cables can damage the cables.

Figure 5-2   Cable Management Bracket
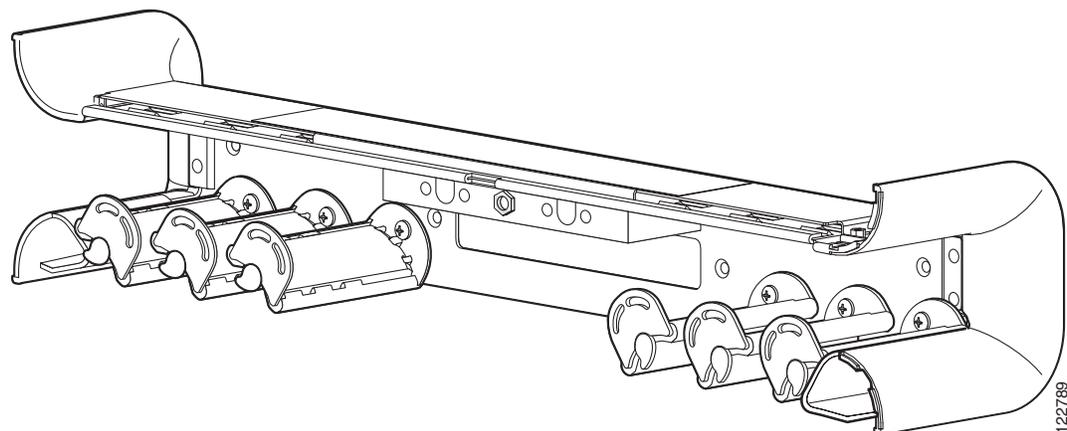
Prerequisites

Be sure that no cables impede your access to the area of the chassis on which you wish to install the bracket.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- 6-in. long number 1 Phillips screwdriver
- Medium flat-blade screwdriver
- Cable management bracket

Steps

To install a cable management bracket, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to an ESD connection socket or a bare metal surface on the chassis.

Step 2   If necessary, remove the Cisco logo bezel from the front of the chassis.

  a.   Gently insert the flat-blade screwdriver between the edge of the bezel and the face of the chassis and pry the bezel loose.

  The bezel is attached to the front of the chassis with four ball studs.

  b.   Pull the bezel firmly toward you to detach it.

Step 3   Position the cable management bracket on the chassis.

Step 4   Insert and tighten the screws to secure the bracket to the chassis.

⌕
Tip   For ease of attachment, install the inner screws first.

⚠
Caution   Be careful not to damage the plastic bracket arms.

Step 5   Reattach the logo bezel by snapping it back onto the front of the chassis.

What to Do Next

Use the cable management bracket to organize your cables. Then install the inlet grille as described in the next section.

Installing the Inlet Grille—Fixed Configuration Power Supply

This section describes how to install the inlet grille on a Cisco CRS 8-slot line card chassis with a fixed configuration power supply installed. The inlet grille covers the power module and air intake areas at the bottom of the front (PLIM) side of the chassis, just below the card cage. Figure 5-3 shows the inlet grille that can be installed on a Cisco CRS 8-slot line card chassis with a fixed configuration power supply.

Figure 5-3   Inlet Grille—Fixed Configuration Power Supply
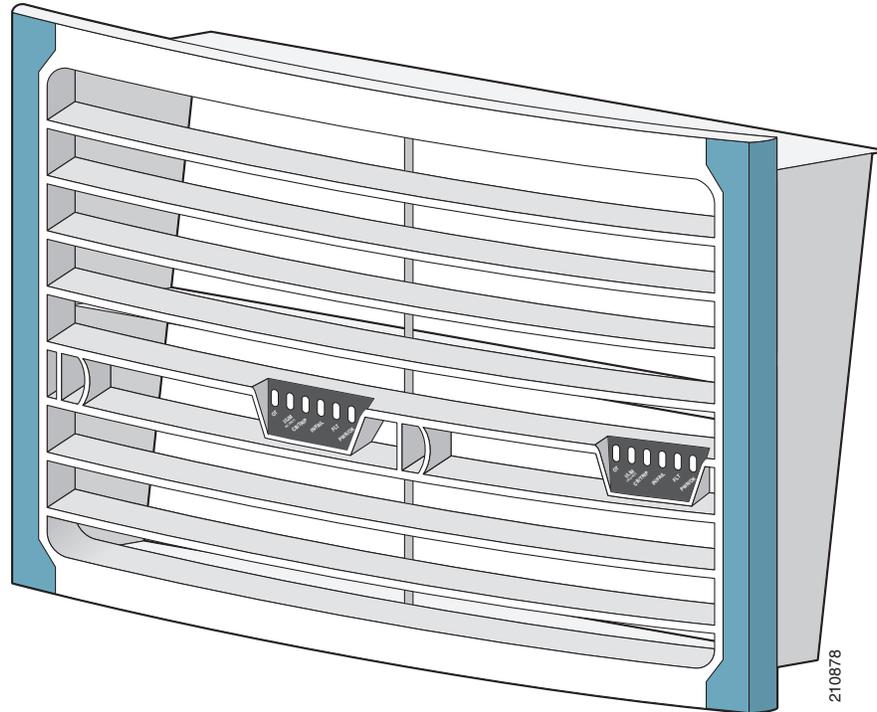
Prerequisites

Before installing the inlet grille, you should mount the chassis in a rack and remove the rear handle pulls. See *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*.

Required Tools and Equipment

- ESD-preventive wrist strap
- Inlet grille (Cisco product number: CRS-8-FRNT-GRILL=)
- 6 in. long number 1 Phillips screwdriver
- Left AC rectifier power handle (Cisco product number: FABMTL,EXTENSION,PWR,L,HQ,HFR)
- Right AC rectifier power handle (Cisco product number: FABMTL,EXTENSION,PWR,R,HQ,HFR)

Steps

To install the inlet grille, perform the following steps:

Step 1   Remove the new inlet grille from its packaging, then set the packaging aside.

Step 2   Remove the AC rectifier power handles from their package.

Step 3   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 4   Use the large Phillips screwdriver to attach the left AC rectifier power handle.

Step 5   Use the screwdriver to attach the right AC rectifier power handle.

Step 6   Align and insert the hooks at the bottom of the inlet grille into the cutouts at the bottom of the chassis casing on the front (PLIM) side of the chassis, just in front of the power modules.

Step 7   Rotate the top of the inlet grille toward the chassis, and snap it into place on the ball studs.

What to Do Next

After performing this task, you may power on the chassis. See Chapter 2, "Installing and Removing Power Components."

If you are replacing the previous version of the inlet grille with the new version, you must also replace the AC rectifier power handles with the new ones provided with the new inlet grille. These new power handles are necessary because the old power handles do not extend through the newly designed inlet grille. You can do this procedure with the system still running.

Installing the Inlet Grille—Modular Configuration Power Supply

This section describes how to install the inlet grille on a Cisco CRS 8-slot line card chassis with a modular configuration power supply installed. The grille covers the power module and air intake areas at the bottom of the front (PLIM) side of the chassis, just below the card cage. Figure 5-4 shows the inlet grille that can be installed on a Cisco CRS 8-slot line card chassis with a modular configuration power supply.

Figure 5-4   *Inlet Grille—Modular Configuration Power Supply*
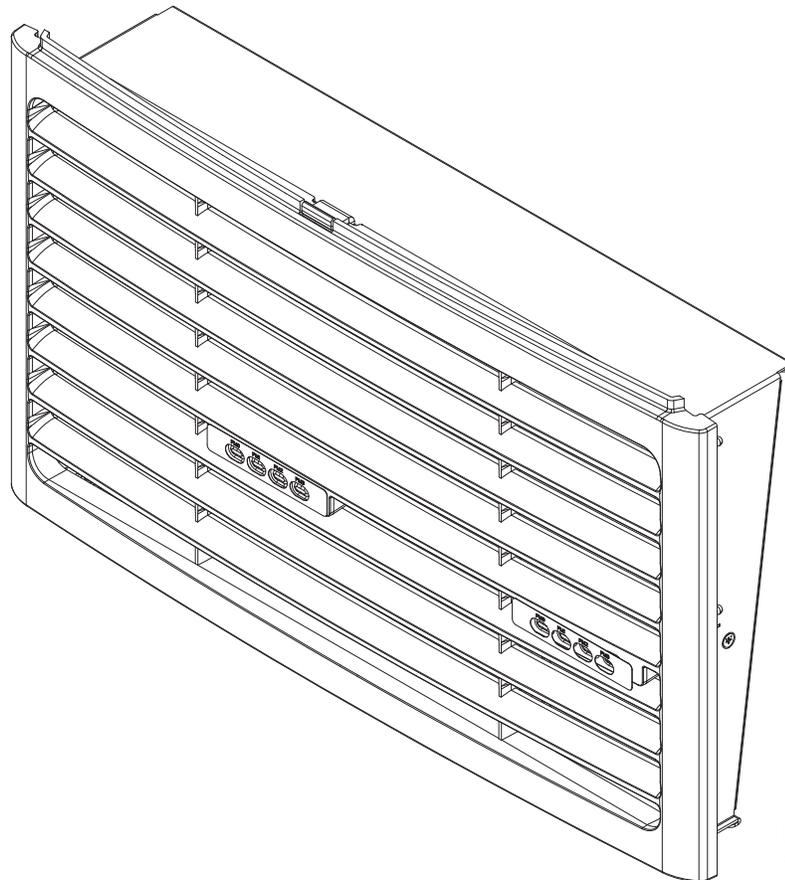
Prerequisites

Before installing the inlet grille, you should mount the chassis in a rack and remove the rear handle pulls. See *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*.

Required Tools and Equipment

- ESD-preventive wrist strap
- Inlet grille (Cisco product number: CRS-8-PW-GRILL)

Steps

To install the inlet grille, perform the following steps:

Step 1   Remove the new inlet grille from its packaging, then set the packaging aside.

Step 2   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 3   Align and insert the hooks at the bottom of the inlet grille into the cutouts at the bottom of the chassis casing on the front (PLIM) side of the chassis, just in front of the power modules.

Step 4   Rotate the top of the inlet grille toward the chassis, and snap it into place on the ball studs.

What to Do Next

After performing this task, you may power on the chassis. See Chapter 2, "Installing and Removing Power Components."

Removing the Inlet Grille—Fixed and Modular Configuration Power Supply

This section describes how to remove the inlet grille from a Cisco CRS 8-slot line card chassis. The procedure is the same for a chassis with a fixed configuration and a modular configuration power supply installed. The grille covers the power module and air intake areas at the bottom of the front (PLIM) side of the chassis, just below the card cage.

Prerequisites

No prerequisites exist for this task.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap

Steps

To remove the inlet grille, perform the following steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   While facing the front (PLIM) side of the chassis, firmly grasp the top outside edges of the inlet grille.

Step 3   Pull the top of the grille firmly away from the chassis; it loosens from the connecting ball studs.

Step 4   Slide the hooks at the bottom of the grille free of the cutouts at the bottom of the chassis casing.

Step 5   Carefully set the inlet grille aside.

What to Do Next

Be sure that all parts have been carefully set aside and repackaged appropriately. If you have ordered the front cover for the 8-slot chassis, proceed to the next section for installation instructions.

Installing the Front Cover

This section describes how to install the front cover. The front cover protects the card cage on the front (PLIM) side of the chassis.

Figure 5-5 shows the front cover installed on the Cisco CRS 8-slot line card chassis.

Figure 5-5   *Front Cover Installed on Chassis*
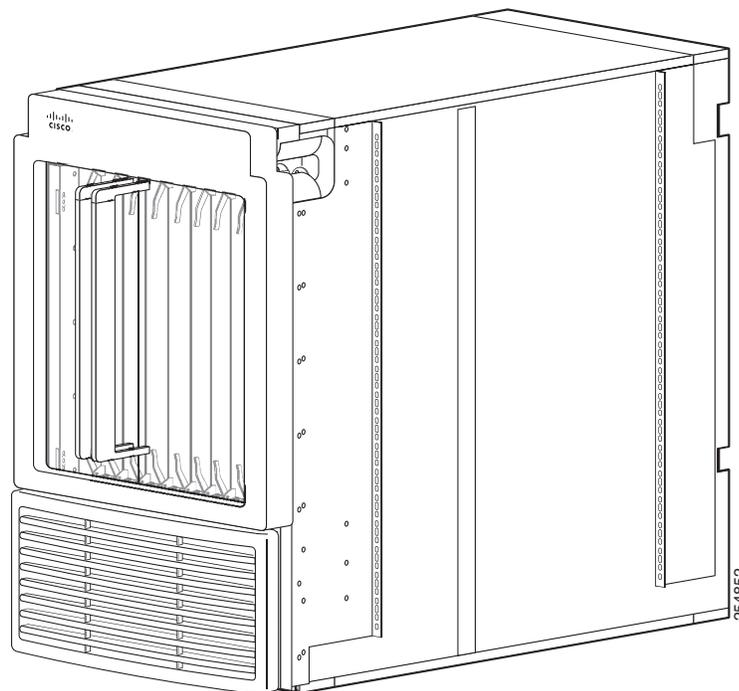
Prerequisites

Before installing the front cover, you should mount the chassis in a rack and remove the rear handle pulls. See *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*.

Required Tools and Equipment

- ESD-preventive wrist strap
- Large Phillips screwdriver
- Front cover (Cisco product number: CRS-8-FRONT-COVER=)

Steps

To install the front cover, perform the following steps:

Step 1 Remove the new front cover from its packaging, then set the packaging aside.

Step 2 Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 3 Install the ball stud retainer brackets on the vertical chassis rack rails, two on the left and two on the right, as shown in Figure 5-6.

Figure 5-6   Location of Ball Stud Retainer Brackets on Vertical Chassis Rack Rails
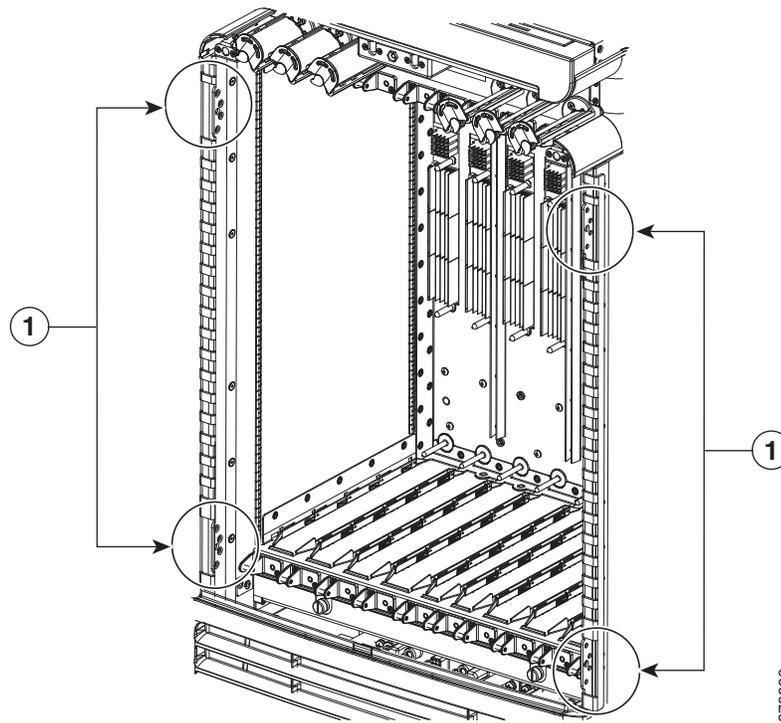
1	Ball stud retainer brackets

Step 4 Using the screwdriver, tighten the four flat head screws that attach each ball stud retainer bracket to the vertical chassis rack rails, as shown in Figure 5-7.

Figure 5-7   Attaching the Ball Stud Retainer Bracket to the Left Vertical Chassis Rack Rail.
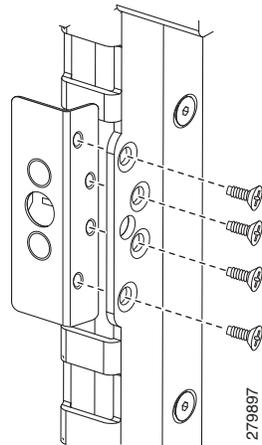
Step 5   Align the four ball studs on the front cover with the holes on the ball stud retainer brackets.

Step 6   Firmly press until the four ball studs snap into place.

What to Do Next

After performing this task, you may power on the chassis. See Chapter 2, "Installing and Removing Power Components."

Removing the Front Cover

This section describes how to remove the front cover. The front cover protects the card cage on the front (PLIM) side of the chassis.

Prerequisites

There are no prerequisites for this task.

Required Tools and Equipment

- ESD-preventive wrist strap

Steps

To remove the front cover, follow these steps:

Step 1   Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Step 2   While facing the front (PLIM) side of the chassis, firmly grasp the outside edges of the front cover.

Step 3   Pull the front cover firmly away from the chassis; the four ball studs on the front cover loosen from the four ball stud retainer brackets installed on the vertical chassis rack rails.

Step 4   Carefully set the inlet grille aside.

What to Do Next

Be sure that all parts have been carefully set aside and repackaged appropriately.

APPENDIX **A**

Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Specifications

Table A-1 lists the specifications for the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis.

Table A-1   Cisco CRS 8-Slot Line Card Chassis Component and Power Specifications

Supported Cards and Modules	8 modular services cards (MSCs), forwarding processor (FP) cards, or label switch processor (LSP) cards (line cards)
	8 physical layer interface modules (PLIMs), one for each MSC, FP, or LSP
	4 switch fabric cards (SFCs)
	2 route processor (RP) cards or 2 performance route processor (PRP) cards
	2 fan trays
	1 air filter
Power Distribution Units, Fixed Configuration	2 AC or 2 DC power distribution units (PDUs) (cannot mix AC and DC PDUs in the chassis)
DC PDU	Supports 1 DC power entry module (PEM)
AC PDU	Supports 1 AC rectifier module
Power Shelves, Modular Configuration	2 AC or 2 DC power shelves (cannot mix AC and DC power shelves in the chassis)
DC power shelf	Accepts up to 4 DC PMs
AC power shelf	Accepts up to 3 AC PMs
Maximum Power Consumption, Fixed Configuration	This represents total input power.
Maximum DC	8.0 kW (assuming 94% efficiency)
Maximum AC	8.5 kW (Delta or Wye 3-phase) (assuming 88% efficiency)
	Note Proper grounding is also required at the site to ensure that equipment is not damaged by lightning or power surges.

Table A-1   Cisco CRS 8-Slot Line Card Chassis Component and Power Specifications (continued)

Maximum Power Consumption, Modular Configuration	This represents total input power.
Maximum DC	9.5 kW (assuming 88% efficiency)
Maximum AC	9.8 kW (assuming 92% efficiency)
	Note Proper grounding is also required at the site to ensure that equipment is not damaged by lightning or power surges.
DC Power Lug Torque Ranges	
Minimum torque	20 in-lb (2.2 N-m)
Maximum torque	30 in-lb (3.3 N-m)
Power Redundancy, Fixed Configuration	
DC	2N: Three "A" battery plant feeds for one PDU, and three "B" battery plant feeds for the other PDU
AC (Delta or Wye 3-phase)	2N: Two independent Delta or Wye 3-phase power sources required
Power Redundancy, Modular Configuration	
DC	2N: Up to four A battery plant feeds and up to four B battery plant feeds required.
AC	2N: Up to three A AC single-phase power sources and up to three B AC single-phase power sources required.
Inrush current, Fixed Configuration	
DC	75 A
AC	160 A
Inrush current, Modular Configuration	
DC	90 Apk max
AC	30 Apk max
DC Input, Fixed Configuration	
Nominal input voltage	–48 VDC North America –54 VDC Telco (RBOC) –60 VDC International (range –40.5 to –75 VDC)
Input current (PDU rated for 60 A)	56 A (nominal) 66 A at –40.5 VDC (maximum)
DC Input, Modular Configuration	
Nominal input voltage	–48 VDC North America –60 VDC International (range –40 to –72 VDC)

Table A-1   Cisco CRS 8-Slot Line Card Chassis Component and Power Specifications (continued)

Input current	50 A max @ –48 VDC 40 A max @ –60 VDC 60 A at –40 VDC (maximum)
AC Input, Delta 3-phase	3W + PE
Input voltage	3-phase 200 to 240 VAC (nominal) (range 170 to 264 VAC, phase-to-phase)
Line frequency	50 to 60 Hz (range 47 to 63 Hz)
Recommended AC service (PDU rated for 24 A)	30 A
AC Input, Wye 3-phase	3W + N + PE
Input voltage	3-phase 200 to 240 VAC (nominal) (range 170 to 264 VAC, phase-to-neutral) (range 295 to 457 VAC, phase-to-phase)
Line frequency	50 to 60 Hz (nominal) (range 47 to 63 Hz)
Recommended AC service (PDU rated for 14 A)	16 A International 20 A North America
AC Input, Modular Configuration	
Input voltage	Single-phase 200 to 240 VAC (nominal) (range 180 to 264 VAC)
Line frequency	50 to 60 Hz (nominal) (range 47 to 63 Hz)
Recommended AC service	16 A

Table A-2 lists the environmental specifications for the Cisco CRS 8-slot line card chassis.

Table A-2   Cisco CRS 8-Slot Routing System Environmental Specifications

Description	Value
Temperature	Operating, nominal: 41° to 104°F (5° to 40°C) Operating, short-term: 23° to 122°F (–5° to 50°C) Nonoperating: –40° to 158°F (–40° to 70°C)
Humidity	Operating: 5 to 85% noncondensing Nonoperating: 5 to 90% noncondensing, short-term operation
Altitude	1 to 5,906 ft (-60 to 1,800 m) at 122°F (50°C), short-term Up to 13,123 ft (4,000 m) at 104°F (40°C) or below
Heat dissipation	27,350 BTUs/hr
External cooling requirements	2.3 tons
Acoustic noise	74 dB at 3.28 ft. (1 meter) in front of chassis (nominal reading at room temperature)

Table A-2   Cisco CRS 8-Slot Routing System Environmental Specifications (continued)

Description	Value
Shock	Operating: 5 to 500 Hz, 0.5g[1] (0.1 oct/min)[2] Nonoperating: 5 to 100 Hz, 1 g (0.1 oct/min) 100 to 500 Hz, 15 g (0.2 oct/min) 500 to 1000 Hz, 1.5 g (0.2 oct/min)
Vibration	Operating: 0.35 Grms[3] from 3 to 500 Hz Nonoperating: 1.0 Grms from 3 to 500 Hz

1. g = Gravity

2. oct/min = Octave per minute

3. Grms = The root mean square value of acceleration, where 1G equals 32.17 ft/sec (9.81 m/sec).

APPENDIX B

Product IDs for the Cisco CRS 8-Slot Line Card Chassis

This appendix provides information about the product IDs for components of the Cisco CRS Carrier Routing System 8-Slot LCC. It contains the following tables:

- Cisco CRS 8-Slot Line Card Chassis Component Product IDs, page B-1
- Optional Line Card, PLIM, SIP, and SPA Product IDs, page B-3

These tables list the components that make up the routing system, their product IDs (the part numbers to use to order the components), and descriptions.

Note Although this appendix provides product IDs for routing system components, the Cisco online ordering and pricing tool has the most up-to-date information on the routing system and product IDs. You can access the ordering tool at the following URL (login required), and enter a search term such as "CRS" to view a list of components:
http://www.cisco.com/cgi-bin/front.x/pricing

Note For a complete list of line cards, route processors, SPAs and SIPs, and interface modules supported in the Cisco CRS 8-slot line card chassis, go to the Cisco Carrier Routing System Data Sheets at:
http://www.cisco.com/en/US/products/ps5763/products_data_sheets_list.html

Cisco CRS 8-Slot Line Card Chassis Component Product IDs

Table B-1 lists the product IDs for components in the Cisco CRS 8-slot LCC.

Table B-1   8-Slot Routing System Component Product IDs

Component	Product ID	Description
CRS 8-slot routing system	CRS-8/S	Cisco CRS 8-slot routing system
CRS 8-slot line card chassis	CRS-8-LCC(=)	Cisco CRS 8-slot line card chassis (spare chassis)
Fan tray	CRS-8-LCC-FAN-TR(=)	Cisco CRS 8-slot fan tray and fans (spare) (2 required for each chassis)
Air filter	CRS-8-LCC-FILTER(=)	Line card chassis filter pack (spare)

Table B-1   8-Slot Routing System Component Product IDs (continued)

Component	Product ID	Description
Inlet grille	CRS-8-FRNT-GRILL(=)	Line card chassis inlet air grille—fixed configuration power
	CRS-8-PW-GRILL(=)	Line card chassis inlet air grille—modular configuration power
Installation kit	CRS-8-INSTALL-KT(=)	Line card chassis installation kit (includes a set of horizontal shelf brackets, mounting screws, and other items)
Fixed Configuration Power Components		
Power module filter	CRS-8-PWR-FILTER(=)	Filters (five per pack) for AC rectifier and DC PEM
AC Delta power components		
AC Delta PDU	CRS-8-LCC-PDU-ACD(=)	Cisco CRS AC Delta power distribution unit (two required for each chassis)
AC rectifier module	CRS-8-AC-RECT(=)	Cisco CRS AC rectifier module (two required for each chassis, one for each PDU)
AC Wye power components		
AC Wye PDU	CRS-8-LCC-PDU-ACW(=)	Cisco CRS AC Wye power distribution unit (two required for each chassis)
AC rectifier module	CRS-8-AC-RECT(=)	Cisco CRS AC rectifier module (two required for each chassis, one for each PDU)
DC power components		
DC PDU	CRS-8-LCC-PDU-DC(=)	Cisco CRS DC power distribution unit (two required for each chassis)
DC PEM	CRS-8-DC-PEM(=)	Cisco CRS DC PEM[1] (two required for each chassis, one for each PDU)
Modular Configuration Power Components		
AC power components, single-phase		
AC power shelf	CRS-8-PSH-AC(=)	Cisco CRS single-phase AC power shelf (two required for each chassis)
AC PM	CRS-PM-AC(=)	Cisco CRS AC PM[2] (up to three required for each power shelf)
DC power components		
DC power shelf	CRS-8-PSH-DC(=)	Cisco CRS DC power shelf (two required for each chassis)
DC PM	CRS-PM-DC(=)	Cisco CRS DC PM (up to four required for each power shelf)
Switch fabric cards		
Switch fabric cards	CRS-8-FC/S(=) CRS-8-FC140/S(=) CRs-8-FC400/S (=) (200G mode)	Cisco CRS switch fabric card (half-height) (four required for each chassis)

Table B-1   *8-Slot Routing System Component Product IDs (continued)*

Component	Product ID	Description
Switch fabric blank	CRS-8-FC-BLANK(=)	Blank card carrier for each switch fabric slot (used during shipment, must be replaced by a switch fabric card)
Switch fabric handle	CRS-8-FC-HANDLE(=)	Handle for carrying card (spare)
Route processor card		
Route processor (RP)[3]	CRS-8-RP(=)	Cisco CRS RP card (one required for each chassis; for redundant operation, you also need CRS-8-RP/R=)
Route processor, redundant	CRS-8-RP/R(=)	Optional route processor for redundant RP operation (one required for each chassis, along with CRS-8-RP=)
Route processor memory	CRS-MEM-2G(=) CRS-MEM-4G(=)	RP memory module, 2 gigabytes RP memory module, 4 gigabytes
Route processor blank	CRS-8-RP-BLANK(=)	Blank card carrier for each route processor slot (used during shipment, must be replaced by a route processor card)
Performance route processor (PRP)[4]	CRS-8-PRP-6G(=) CRS-8-PRP-12G(=)	Cisco CRS performance route processor card
Route processor handle	CRS-8-RP-HANDLE(=)	Handle for carrying card (spare)

1. PEM = power entry module

2. PM = power module

3. RP = route processor

4. PRP = performance route processor

Optional Line Card, PLIM, SIP, and SPA Product IDs

Table B-2 and Table B-3 list the product IDs for the modular services cards (MSCs), forwarding processor (FP) cards, label switch processor (LSP) cards (line cards); physical layer interface modules (PLIMs); SIPs and SPAs available for the Cisco CRS 8-slot LCC.

Note   For a complete list of PLIM product IDs, see the *Cisco CRS Carrier Routing System Ethernet Physical Layer Interface Module Installation Note*. For a complete list of SIP and SPA product IDs, see the *Cisco CRS SIP and SPA Hardware Installation Guide*.

Table B-2   Line Card Component Product IDs

Component	Product ID	Description
MSC[1]	CRS-MSC-B(=), CRS-MSC-140G(=) CRS-MSC-X (200G)	Cisco CRS Layer 3 modular service card (every MSC must have an associated PLIM)
FP card LSP card	FP40 FP-140 CRS-FP-X (200G) CRS-LSP	Cisco CRS Layer 3 forwarding processor (every FP must have an associated PLIM) Cisco label switch processor (every LSP must have an associated PLIM)
MSC impedance carrier	CRS-MSC-IMPEDANCE(=)	Blank card carrier for each empty MSC slot (required for EMI compliance and cooling)

1.   Refer to the product data sheet for ordering details.

Table B-3   PLIM Component Product IDs

Component	Product ID	Description
1xOC-768 PLIM	1OC768-POS-SR(=)	1-port OC-768c/STM-256c PLIM, with short-reach optics (POS)
4xOC-192 PLIM	4OC192-POS/DPT-LR(=)	4-port OC-192c/STM-64c PLIM, with long-reach optics (POS or DPT)
	4OC192-POS/DPT-IR(=)	4-port OC-192c/STM-64c PLIM, with intermediate-reach optics (POS or DPT)
	4OC192-POS/DPT-SR(=)	4-port OC-192c/STM-64c PLIM, with short-reach optics (POS or DPT)
	4OC192-POS/DPT-VS(=)	4-port OC-192c/STM-64c PLIM, with very-short-reach optics (POS or DPT)
16xOC-48 PLIM	16OC48-POS/DPT(=) POM-OC48-LR2-LC-C(=) POM-OC48-SR-LC-C(=)	OC-48c/STM-16c PLIM, uses small form-factor pluggable (SFP) modules (POS or DPT) The PLIM uses 1 to 16 single-mode, long- and short-reach optic modules (mixing allowed): • Long-reach optics (POM-OC48-LR2-LC-C=) • Short-reach optics (POM-OC48-SR-LC-C=)
8x10-GE XENPAK PLIM	8-10GBE(=) CRS-XENPAK10GB-LR(=)	10-GE PLIM, uses XENPAK optic modules. The PLIM uses 1 to 8 single-mode, long-reach optic modules: Long-reach optics (CRS-XENPAK10GB-LR=)
8x10-GE and 4x10-GE XFP PLIMs	8-10GBE-WL-XFP(=) 4-10GBE-WL-XFP(=)	10-GE PLIM, uses XFP optic modules. These PLIMs use 1 to 8 (or 1 to 4) single-mode, XFP optic modules.

Table B-3 **PLIM Component Product IDs (continued)**

Component	Product ID	Description
20x10-GE and 14x10-GE XFP PLIMs	20X10GBE-WL-XFP 14X10GBE-WL-XFP	10-GE PLIM, uses XFP optic modules. These PLIMs use 1 to 20 (or 1 to 14) single-mode, XFP optic modules.
1x100-GE CFP PLIM	1X100GBE(=)	100-GE PLIM, uses one CFP optic module.
PLIM impedance carrier	CRS-INT-IMPEDANCE(=)	Blank card carrier for each empty PLIM slot (required for EMI compliance and cooling)

Table B-4   SIP and SPA Component Product IDs

Component	Product ID	Description
Cisco CRS SPA Interface Processor-800	CRS1-SIP-800	Occupies one PLIM slot on the Cisco CRS 16- and 8-Slot LCC. Supports six normal-height SPAs or three double-height SPAs or any combination in between.
1-Port OC-192c/ STM-64 POS/RPR XFP SPA	SPA-OC192POS-XFP	—
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS	—
8-Port OC-12c/STM-4 Multirate POS SPA	SPA-8XOC12-POS	—
8-Port Gigabit Ethernet SPA	SPA-8X1GE	—